the OIL AND GAS JOURNAL

JULY 22, 1957

How Rising Octanes Will Affect '58 Cars

Compression ratios will move upward . . .
Horsepower will climb again . . .
More and more gadgets will be the rule . . .

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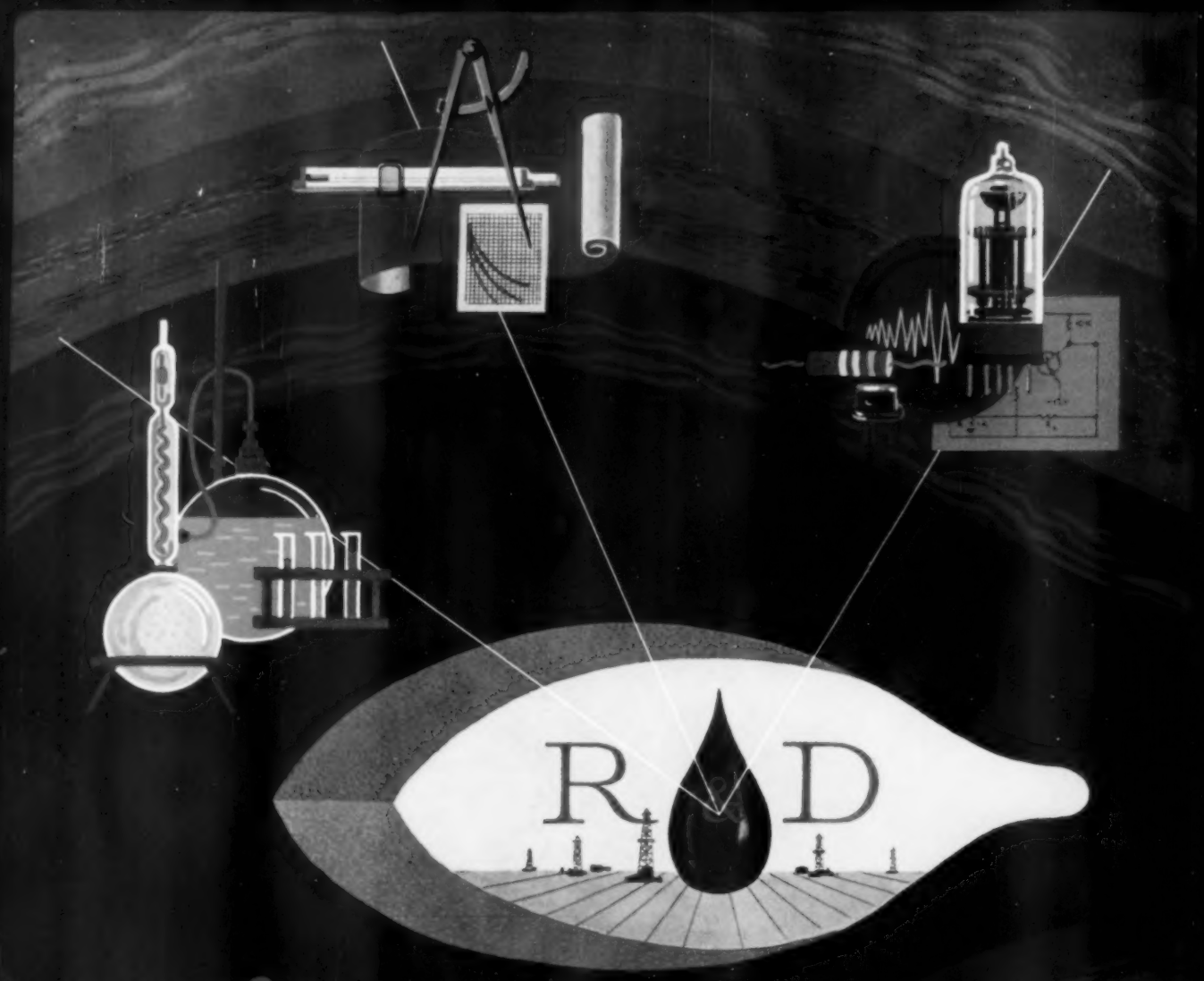
More L.P.G. Floods Coming:

Continental to start August 1 in Short Junction p. 50

Sunray's planning a pilot program in young Bisti p. 51

Unusual Flood Recovers 60 Per Cent

p. 101



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Behind all the complexities of modern petroleum technology lies science, the research and development necessary to convert the basic laws of nature into the benefits of man.

Oilmen continue to look to Halliburton Research and Development for new ways to discover unknown pay zones and still better ways to improve present production.

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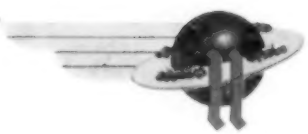

HALLIBURTON OIL WELL CEMENTING COMPANY

DUNCAN, OKLAHOMA

JOURNAL News Letter

July 22, 1957
Tulsa, Okla.

Prices on oil-field equipment and supplies are holding firm:

Suppliers and manufacturers are reluctant to raise their prices in spite of the July 1 jump of $6 a ton in basic steel.

But a price increase matching those already posted for pipe and oil-country tubular goods is inevitable--likely within 90 days.

The amount is yet to be determined--but it'll be at least 5 per cent.

Here's the general picture at midmonth:

Manufacturers--holding price schedules at least until they draw down on steel inventories stocked at the lower prices. Meanwhile, their economists are studying new costs, including other materials and wages, to be ready with higher price structure.

Assemblers and fabricators--awaiting price move by makers of component parts, such as engines, transmissions, axles, etc., before determining new prices for oil-field equipment.

Supply houses--also awaiting a move by the manufacturers.

All report the supply and equipment business is highly competitive now and the full impact of the steel-price increase may not be passed on to the customer. Manufacturers and suppliers may have to absorb some of their extra costs themselves.

Strangely, buying habits of the oil industry haven't changed.

Oil men are not rushing to stock up on items ahead of higher prices.

There was a slight flurry in sales of sucker rods recently. But even this now has tapered off.

Only wire rope has joined pipe and tubular goods in the higher prices. Forge fittings, pumps, pumping units, drawworks, sucker rods, bits, and tool joints all are being sold at the old price--at least now.

Here's a peek at the 1958-model autos:

Compression ratios will be higher--9.5:1 for most.

Horsepower will be greater--unweighted average of 250.

More performance and power gadgets will eat away the extra horsepower, however.

Higher-octane gasolines now available from refiners are making the greater compression and horsepower possible.

Octanes this year are comfortably above car requirements. This gives Detroit more room to beef up engines. For the full story on octanes and new engines see p. 43.

Other new-car trends:

Fuel injection may spread a little. Some Cadillac models will have it. This is flying in face of troubles Chevrolet has had with the fuel system.

More foreign cars will make their bow. General Motors will bring in two of its own makes, Vauxhall from England and Opel from West Germany. Ford has marketed its English-made car since 1949, will push it more.

Prices are expected to average $40 to $50 per car more. Luxury models will take the biggest increase in price tags.

Reason for higher prices is familiar: Steel and wages are up.

Gas turbines for passenger cars are out for 1958.

But they still can't be counted as dead. They're going into heavy commercial and military vehicles.

It's no secret that Ford is shooting for gas turbine-powered vehicles on the road within 5 years.

Ford has given contract to Misco Precision Casting Co., Whitehall, Mich., to develop an economical method of mass producing turbine-wheel assemblies for a gas-turbine engine.

Misco's job is a tough one: Get the cost of turbine-wheel assemblies down to the $20-25 range. Some turbine blades alone now cost $12 each to cast.

The turbine wheel is one of the keys to low-cost turbine production. The thought of a single-cast turbine wheel is very attractive.

Engineers have many other turbine problems to lick: Noise level, excessive fuel use while idling, etc. But they well might conquer them in the next few years.

Underwriters are sticking to their original estimates of oil-industry losses in Hurricane Audrey: $3 to $5 million.

That covers only the insurable loss. Losses by companies and individuals not covered by insurance will swell the total.

Insurance companies have one warning: Oil claimants likely will be paid off slower than others. The delay will be due to need for specially qualified adjustors.

Jet engines will run on coal.

Australian engineers have turned up this development. They discovered Australian brown coal, firmly pulverized, is adaptable to jet fuels.

One problem: Solids striking the fast moving rotor blades designed to handle a gaseous fuel. But they believe an answer can be found.

Canada is moving fast toward net self-sufficiency in oil.

Imports to Atlantic provinces still are on the upgrade.

But exports to U.S. also should be substantially higher for year.

Signs for the future: Most of the 150,000-bbl. refinery expansion being built or planned in Canada will be based on Western crude.

An unusual pressure-maintenance project is being operated by Conoco in Todd crinoidal field of Crockett County, West Texas.

Water injection is through only one input well.

But the flood not only has halted decline in bottom-hole pressure but also has steadily increased it in the 1,700-acre field.

The result: Estimates of ultimate oil recovery have been increased from 25 per cent before the flood to about 40 per cent (p. 101).

Other oil companies may copy Sun's "hose within a hose" pump.

At least two major marketers--one a three-grade and the other a two-grade seller--are interested. They like the idea of dispensing two or even three grades from the same pump.

Sun inaugurated the multigrade plan last year by automatically blending five grades from one pump on the filling-station island.

Storm warnings are flying for some tank makers.

Sales of heavy steel tanks that hold L.P.G. are off 15-20 per cent.

This is running against a tide of L.P.G. sales which are expected to reach a record 7.4 billion gallons this year.

Tank makers now have little hope of hitting the record 265,695 tanks shipped last year, although a second-half spurt is anticipated.

The explanation: Credit shortages have hit tank distributors at time when they need loans most. Many metropolitan distributors are accumulating used tanks from areas now served by gas or electricity. Critical home-fuel market is not expanding as rapidly as in the past.

But long-range outlook is still good. Small tanks of 110-gal. capacity are still moving, boosted by vehicle conversions. Tank makers also can count on a growing propane-butane market.

Continental Oil reportedly is nearing a breakthrough on its methane-liquefaction work.

Next 2 years may see process in operation.

Most likely customer is Great Britain. There even highly touted atomic energy now costs $3.80 on an M.c.f. basis.

Even if this is halved, it leaves a wide profit margin for moving liquid methane to Europe by tanker.

First step toward another major products line into Chicago will be taken soon.

Ohio Oil Co. plans the 350-mile, 12-in. system. It'll have legs from Wood River and Robinson, Ill., to Champaign and then into Chicago.

Work will start next month on Robinson-Champaign leg.

Main line from Wood River to Chicago will be built next year.

More thin-wall pipe is becoming available.

This is the result of easing in the small-diameter pipe market.

Steel mills in the past have been reluctant to supply the thin-wall lines because of the small tonnage involved.

But recently orders have been filled for pipe with .148-in. wall on a 6-in. crude line.

The sharp drop in tanker rates is hurting Trans Mountain pipeline.

California refiners are finding it cheaper to take on crude from Sumatra and other points rather than by pipeline from Canada.

The situation points up the stiffer competition other American oil producers will face if spot tanker rates continue to sag. The new rates make foreign oil more popular than ever.

For example, at a rate of USMC-30%, Middle East crude has an 18-cent per barrel advantage over Gulf Coast oil laid down in New York. Venezuelan crude has a 3-cent advantage.

Colorado may crack down on gas flaring in Rangely field.

The word is that unless operators come up with an acceptable unitization plan late this week, the conservation commission plans a more stringent order on flaring. Operators meet in Denver Tuesday to lay plans.

This showdown comes as operators had set a September 1 target date to start a long-heralded secondary-recovery program for Colorado's largest field.

Canada's Pincher Creek field has terrific possibilities.

It's the nation's largest gas-condensate reserve. But when Trans-Canada pipeline is completed, it also will be:

...The pipeline's largest source of gas.

...World's greatest source of sulfur from sour natural gas.

...One of largest producers of L. P. G. and condensate.

The most powerful rig in West Texas has a king-size assignment on its first job: Drilling the world's second deepest hole.

The new diesel-electric Rig 44 of Great Western Drilling Co. has spudded a prospective 22,000-ft. test near Fort Stockton. Well is Phillips-Sinclair 1 "A" Montgomery.

If it goes to projected depth, well will be 570 ft. short of record.

El Paso Natural and the affiliated Westcoast Transmission have about wrapped up all the reserves of the big Savanna Creek field in southwestern Alberta. This gas will be moved through the proposed Westcoast line to the Idaho border to meet a Pacific Northwest extension from Spokane.

The holdout has been Northern Natural Gas Producing Co., whose parent company had planned a pipeline from Alberta to Minneapolis. Northern Natural is now dickering with El Paso, is expected to fall in line.

News about

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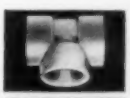

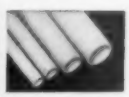

Several manufacturers offer rigid vinyl pipe and fittings made from Geon. Sizes range from ¼ inch for instrument air lines up through 12 inches. Fittings are socket or threaded. Vinyl is normal or high impact.

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TECHNOLOGY—OPERATION

Drilling-Production

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By W. H. Thralls and R. C. Hasson

Part 2 of a two-part series, this article is devoted to stratigraphy and structure, and to handling and processing of the produced oil. Part 1 (OGJ, July 15, 1957) was devoted to exploration and development, physiographic provinces, and some background on the area.

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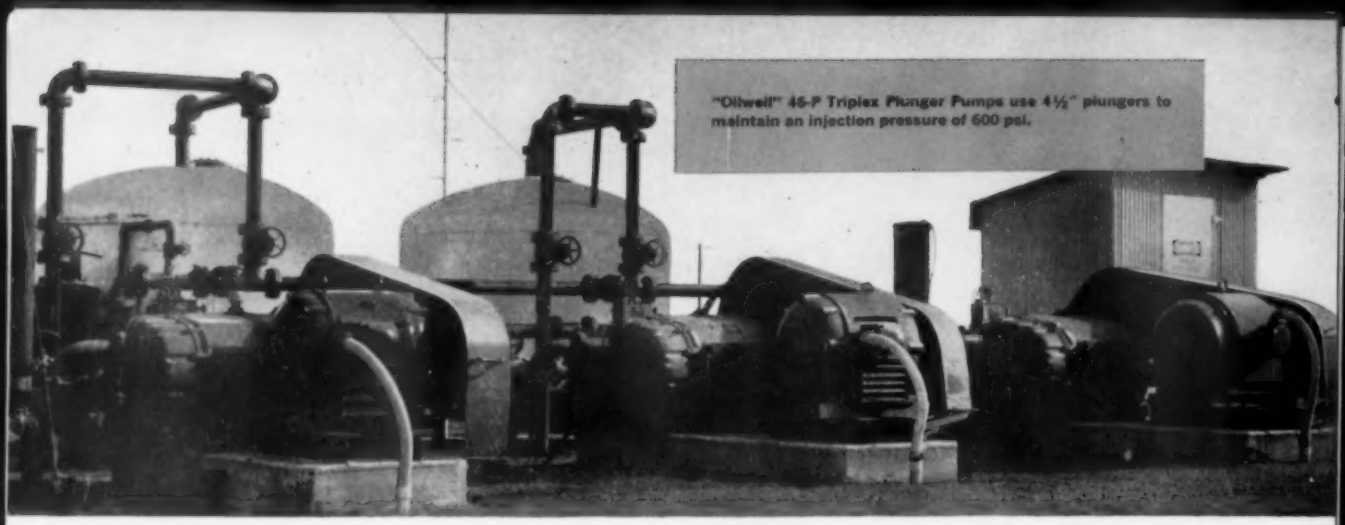

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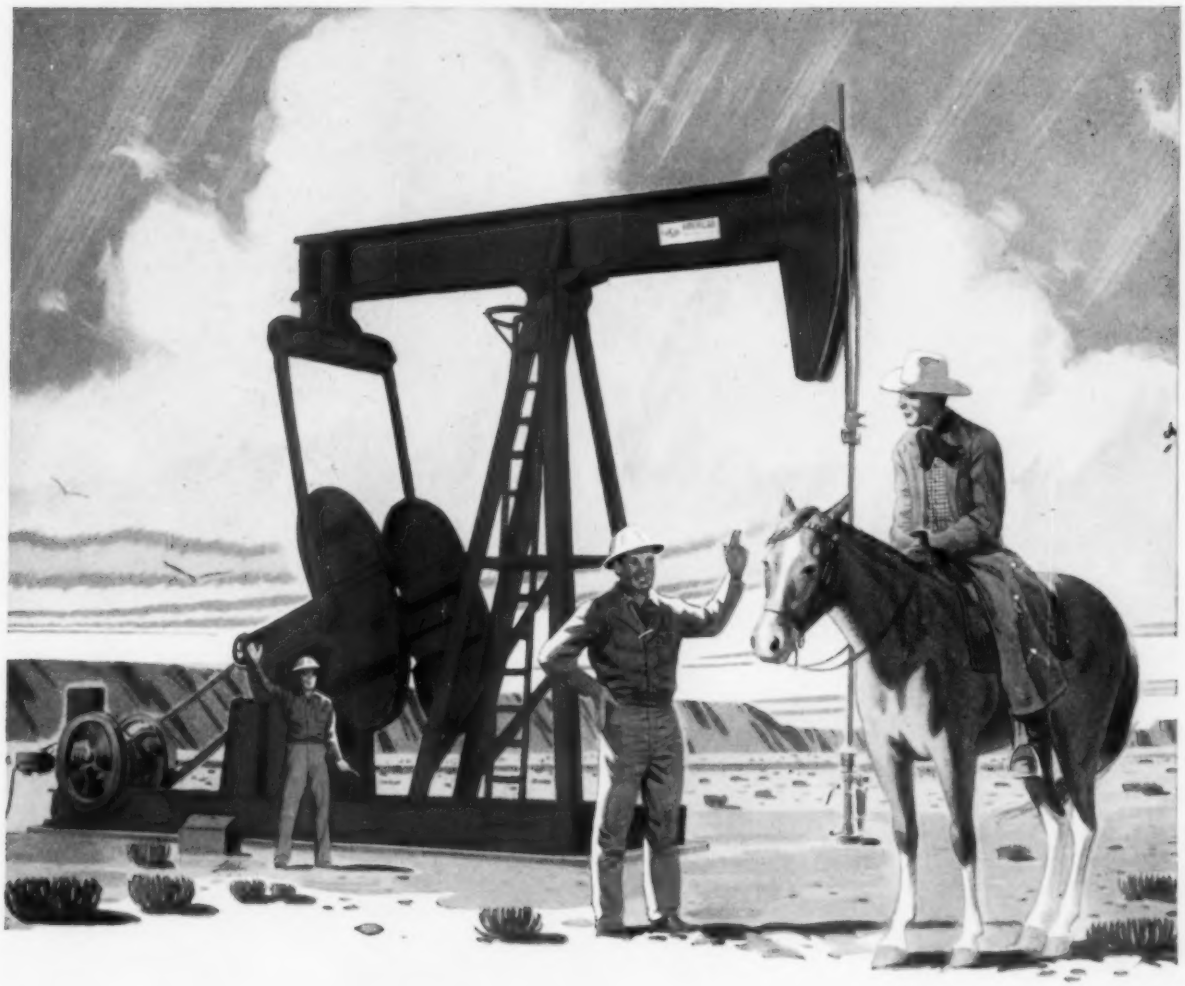

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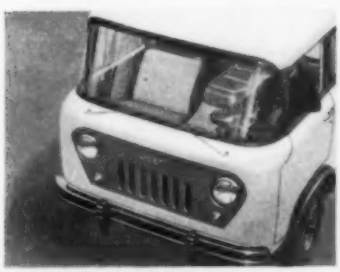
- **Other outstanding features!** It's really a 4-wheel drive truck — *not* a modified 2-wheel drive truck, *not* a conversion! High-torque Hurricane 6-226 engine, time-tested and performance-proved • spacious Safety-View Cab • big wrap-around windshield • wide 63-inch tread for ground-gripping stability in off-road travel • shifts easily into 2-wheel drive for highway travel • with power take-off, operates a wide range of special equipment from winches to belt-driven machinery.

The newest addition to the 4-Wheel-Drive 'Jeep' family...ready for the bigger, tougher jobs!



SPACIOUS SAFETY-VIEW CAB puts you in a "Forward Control" position, gives you greater command of any driving situation.

EXTRA 4-WHEEL-DRIVE 'JEEP' TRACTION takes heavy loads to off-road areas impossible for ordinary vehicles to reach.

'Jeep' / Forward Control

4-Wheel-Drive **FC-170**

WILLYS... world's largest manufacturers of 4-Wheel-Drive Vehicles

Willys Motors, Inc., Toledo 1, Ohio

Bring cuttings up FAST... by reverse circulation

with GUIBERSON

Type J ROTATING DRILLING HEAD

SLIPS, TABLE AND KELLY BUSHING
OIL RESISTANT PACKING RUBBER
POWER TAKE OFF
FULL FLOATING WASHPIPE
UNION OR FLANGE TYPE BOTTOM

Virtually a small rotary table, for work-overs, clean-out work, slim-hole drilling, or drilling in with controlled pressure, the Guiberson Type J Head offers you many exclusive features. It will drill cement plugs, float collars and new hole at an exceptionally fast rate.

BOTTOM CONNECTION	CASING SIZE
Union, Minor Hub with Two 2" Side Outlets	5½" 7"
Union, Standard Minor Hub	8⅝"
Flange, 6" — 600 6" — 900 Series	6"-7"

THE GUIBERSON CORPORATION

ESTABLISHED 1919
DALLAS, TEXAS
U. S. A.

Sold by Oil Field Supply Stores Everywhere

This man knows his salt in sweetening problems

(Dow technician's background of experience aids ethanolamine users)

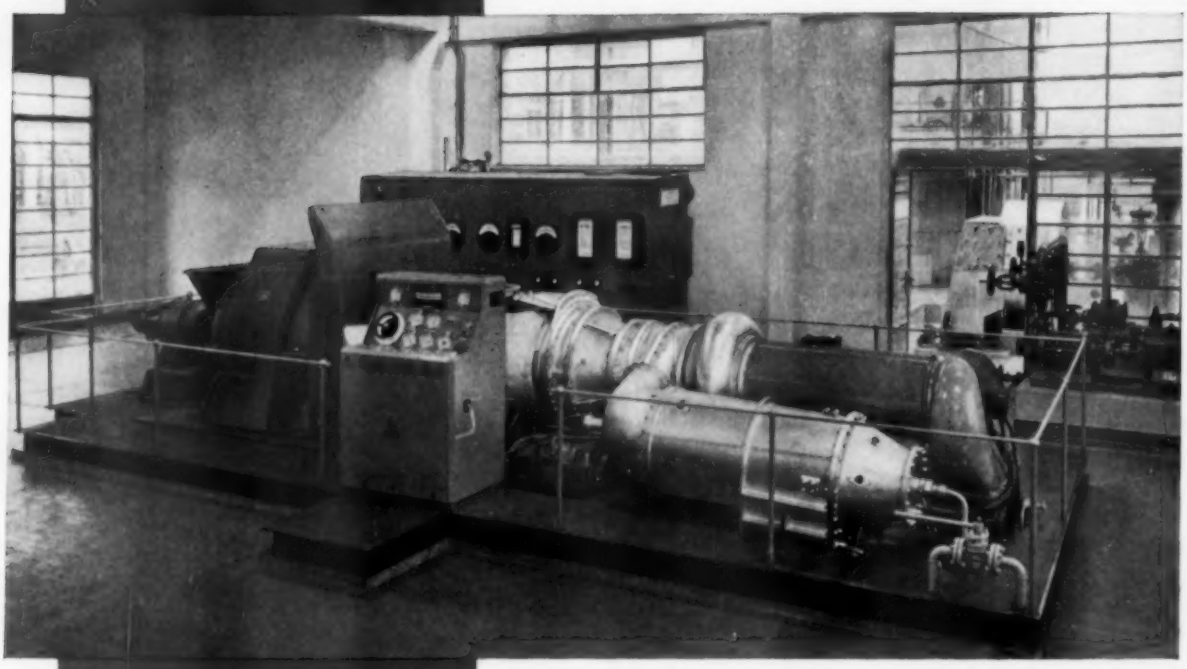
It's true that no one can be right all the time. Because of this fact, your Dow tech service man never stands alone in solving sweetening or dehydration problems.

The conclusions he offers climax a team effort in the lab or are wrestled from an accumulation of data on ethanolamines and glycols as used by gas processors in all parts of the world. Processors' problems and proved solutions are a matter of Dow record which our tech service men refer to constantly. Representing such a backlog of experience and by combining lab talents, these men are hard to stick on a gas processing problem. Often you need only to mention the difficulty.

Corrosion in a sweetening or glycol dehydration unit? Whether the cause is salt in a dehydration unit or contamination in a sweetening unit, your Dow tech service man may have the answer (based on many hours' work of many people) in minutes. It could be in the return mail! THE DOW CHEMICAL COMPANY, Midland Michigan, Dept. GD 818H-1.

YOU CAN DEPEND ON DOW

NOW for the first time...



The Mark TA gas turbine generating power and process steam in a refining application.

all power services in one package

In applications where multiple power services are required such as power generation, compressing, pumping, space heating, refrigeration, air conditioning, drying, or evaporating, the Clark Mark TA gas turbine is the economical choice.

Exhaust gases from this 1,150 bhp. gas turbine contain up to 10,000,000 BTU/H of recoverable energy at a temperature of 870°F. While these gases contain some products of combustion, 90% of the original oxygen content is still present.

The exhaust gases are useful where preheated air is desirable for combustion or supercharging purposes, for drying applications, catalyst regeneration, feedwater heating, evaporation of sea water, etc. These gases can also be used in air to air heat exchangers for space heating or to generate up to 9,500 pounds of low pressure steam per hour for process use. If even higher temperature gases are required, the Mark TA can be used solely as a power gas generator to provide gases of 1020°F at 20-22 psia. and a mass flow of 20 pounds per second.

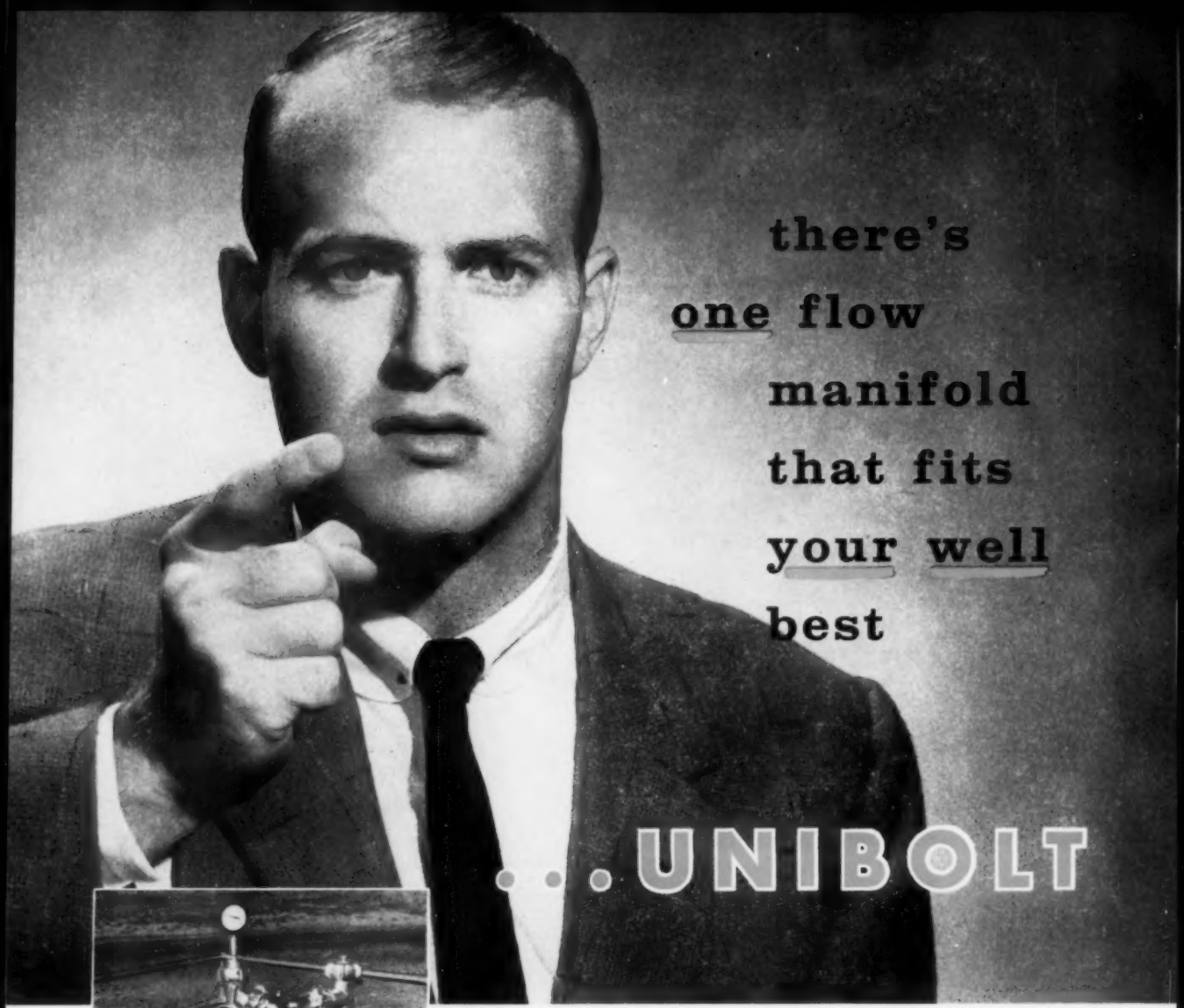
For large stores, auditoriums, hotels, hospitals and office buildings, the Mark TA can provide approximately 1800 tons of air conditioning or refrigeration in the summer using the absorption cycle and also provide steam for heating in the winter. In all applications except power gas generating, this modern gas turbine also supplies 1,150 bhp. of rotative energy for pump, generator, or compressor drive.

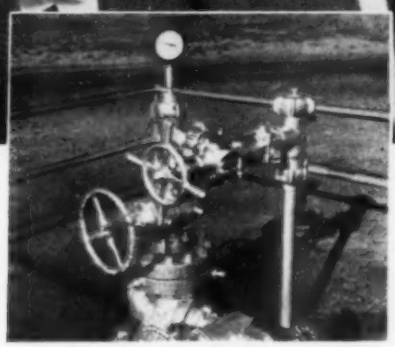
Clark engineers stand ready to assist you in applying the Mark TA gas turbine to your application. Larger units with ratings of 9,500 bhp. are also available from Clark. Write for Bulletin No. 142.

CLARK BROS. CO., OLEAN, N.Y.
One of the Dresser Industries
Offices in Principal Cities Throughout the World

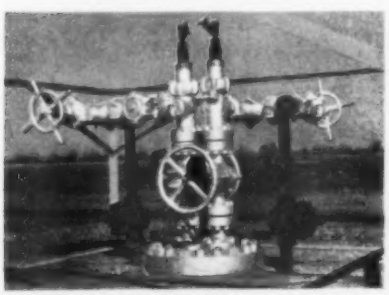
Clark Bros. Co. is licensed to manufacture the Mark TA gas turbine in this country by Ruston-Hornsby, Ltd., Lincoln, England.

CLARK





UNIBOLT Flow Manifolds are available in Tee or Cross Type, 6,000, 10,000, and 15,000 lbs. test.



UNIBOLT Flow Manifolds on a dual parallel string completion.

UNIBOLT Flow Manifolds (unlike flow controls of fixed design) permit any desired arrangement of wing valves and chokes. They may be assembled and tested at the factory to meet your exact requirements. Then, when the well goes on the pump and the Flow Manifold has served its purpose, it may be salvaged as a complete unit for use on another well, or it may be dismantled and its separate units used wherever needed. Its component parts —tee or cross, wing valve, and choke body—interchange with all other UNIBOLT products of the same size.

Remember, too, that a UNIBOLT tee or cross provides a safe, easy connection for a lubricator equipped with the mating half of a UNIBOLT coupling.

If it is your responsibility to specify Christmas tree manifolds, you'll be interested in our "24 reasons why Unibolt Flow Manifolds are better." Let us send you a copy. Write to:

THORNHILL CRAVER CO.

P. O. Box 1184, Houston, Texas

1000 BRINELL DURACASE TRIM...

Stops galling and erosion

Since the introduction of OIC's Duracase Trim, many forged steel valve specs are obsolete. This 13% chrome stainless steel trim with 1000 Brinell, case-hardened wedges and discs assures positive protection against even the simultaneous attack of the three valve-destroying agents—corrosion, erosion, galling.

OIC offers you a choice of two modern body-bonnet connections—union ring or bolted bonnet—on its entire forged steel gate, globe, angle, and check valve line.

In addition, gate valves offer a choice of standard-flow or high-flow body ports, both with 1000 Brinell wedges.

Step up your valve requirements to the modern high-quality standards reflected in OIC valves. Include OIC on your next specification.

For OIC forged steel valve specification literature, write for Forms No. 195 and 195-R.

THE OHIO INJECTOR COMPANY • WADSWORTH, OHIO

OIC VALVES | FORGED & CAST STEEL, LUBRICATED PLUG, BRONZE & IRON VALVES

DMS® and DME®

Latest surfactant mud materials

give fast, trouble-free drilling

DMS & DME drilling mud additives are one of the mud industry's biggest advances in decades: a "surfactant mud" system with unique in-the-hole advantages:

1. **INHIBITS SWELLING AND DISPERSION OF CLAYS.** Shale cuttings do not disperse in the mud. Formation permeability is not reduced because formation clays do not swell.

2. **MOVES CUTTINGS OUT FASTER.** Lubricates cuttings and gets them away from the bit faster and out of the hole quicker.

3. **QUICKER SETTLING IN MUD PITS.** Drilled solids settle out faster, giving less solids build-up, easy mud control, less cost for weight materials.

4. **STABLE TO HIGH TEMPERATURES.** DMS & DME muds are stable at the highest temperatures ye encountered in drilling.

These new surfactant muds are easy to use, easy to control. They let you drill faster with less strain, and pull a clean bit from a clean hole. DMS & DME are distributed to the oil industry everywhere through Baroid Division, National Lead Company. Write direct to Baroid using convenient coupon below, for a complete 10-page technical bulletin on DMS & DME.

COMPOUND MUD WITH DMS & DME TO MEET YOUR SPECIAL NEEDS

Water-phase muds can be made easily with DMS additive and standard materials. For oil emulsion muds, add DME. Both are nonionic chemicals. Other principal mud additives generally used include a polyanionic filtration control agent and electrolyte such as calcium sulfate (for a calcium surfactant mud) or sodium chloride (for a sodium surfactant mud). Complete applications are described in DMS-DME bulletin from Baroid Division, National Lead Co.

ANTARA gaf

Baroid Division, National Lead Co.
P. O. Box 1675, Houston 1, Texas

Gentlemen: Send me your DMS & DME bulletin.

Name_____ Title_____

Company_____

Address_____

City_____ State_____

ANTARA CHEMICALS
A SALES DIVISION OF
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SALES OFFICES: New York • Boston • Providence • Philadelphia • Charlotte • Chattanooga • Chicago Portland, Ore. • San Francisco • Los Angeles. IN CANADA: Chemical Developments of Canada, Ltd., Montreal

Wrong Way To Cut Plant Investment

Shortening the engineering effort required for a multi-million-dollar process plant may seem to be the easiest way to cut investment costs. Actually it may be the surest way to increase costs of materials and field labor, and to endanger the ultimate efficiency of the plant. Additional time spent on engineering before construction begins usually can save thousands of dollars in materials and thousands of man-hours in the field.

Better engineering is the basis of The M. W. Kellogg Company's construction business, and the reason for its reputation among leading oil refiners and chemical companies the world over. If your firm is contemplating new petroleum or petrochemical processing facilities, it will pay you to investigate Kellogg's better engineering approach to the problems of rising labor and materials costs.

REFINERY PROCESS DIVISION

THE M. W. KELLOGG COMPANY

711 THIRD AVENUE, NEW YORK 17, N. Y.

A SUBSIDIARY OF PULLMAN INCORPORATED

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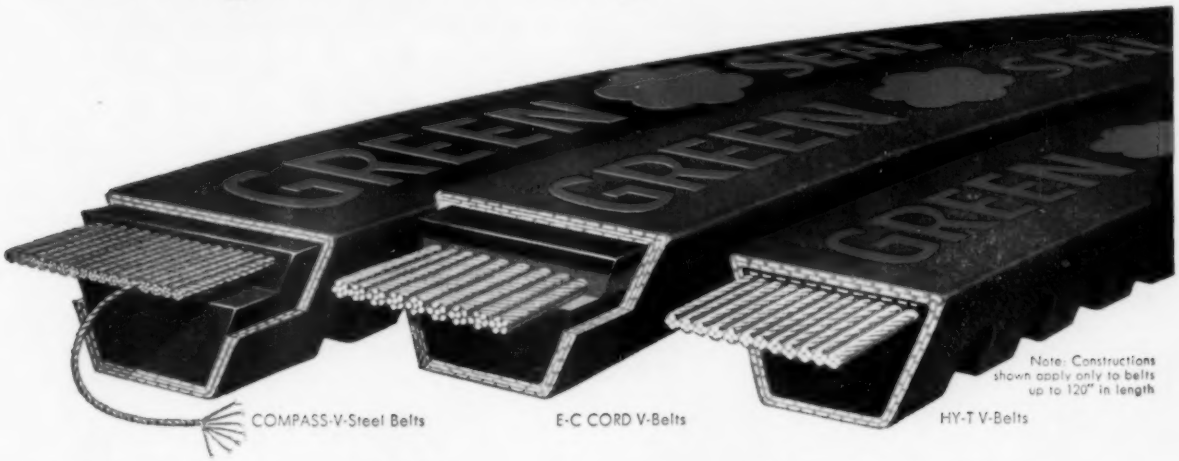
M KELLOGG W

Now—V-Belts with the Green Seal solve the major multiple drive problem



COMPASS-V-Steel Belts

E-C CORD V-Belts

HY-T V-Belts

Note: Constructions shown apply only to belts up to 120" in length

The Green Seal stands for true dimensional stability in V-belts. And with Green Seal dimensionally stable belts you can be sure that matched sets are truly matched and will stay matched—that mismatching (the biggest problem in belting multiple drives successfully) is a thing of the past.

The key to dimensional stability lies in the tension members of the belt. For many years, steel cables as developed by Goodyear were the only length stable load carriers, but now they have been joined by synthetic cords, thanks to the amazing Triple-Tempered 3-T process.

The 3-T process is an exclusive method of tempering the cord with Tension, Temperature and Time for maximum strength and minimum change in dimensions. This assures no change in length during storage plus greatly increased shock- and stretch-resistance on the drive.

The end result is smoother, longer-running teams of belts that give you maximum, trouble-free, horsepower hours at minimum cost. What better reason for specifying V-belts with the Green Seal?

DIMENSIONALLY STABLE V-BELTS with the GREEN SEAL by GOODYEAR

THE GREATEST NAME IN RUBBER

The Goodyear Tire & Rubber Company, Industrial Products Division, Dept. 794, Akron 16, Ohio

Please send me more information about how V-Belts with the Green Seal solve the major problem in belting multiple V-belt drives.

Name_____

Company_____

Street Address_____

City_____ **Zone**_____ **State**_____

Compass, E-C Cord, Hy-T, Green Seal—T. M.'s The Goodyear Tire & Rubber Company, Akron, Ohio

Do You Buy Desiccants?

Reynolds Activated Aluminas are low in cost, have high capacity, are inert to most chemicals

Reynolds Activated Aluminas have no written formula. They are mixtures of various forms of Al_2O_3 and H_2O. Their component water contents vary from 0% in aluminum oxide to 34.6% in trihydrated aluminum oxide.

In-between compounds are formed under carefully controlled conditions to generate crystalline arrangements with maximum surface area to take advantage of the direct relationship of high surface area to degree of adsorption. The following table indicates the high adsorptive capacity of activated aluminas.

Two grades of activated alumina are available at present. The two grades are identical chemically, but differ only slightly in their capacity to adsorb moisture.

TYPICAL CHEMICAL PROPERTIES OF GRADES R-2101 AND R-2102 ACTIVATED ALUMINA

(Analyses in Percent on Dry Basis)

Al_2O_3	Na_2O	SiO_2	Fe_2O_3	TiO_2	Combined H_2O
91.5	0.75	0.10	0.02	0.002	7.0

TYPICAL DYNAMIC ADSORPTIVE CAPACITY

(Capacity in Percent on Dry Basis)

Grade	At 10% Relative Humidity	At 20% Relative Humidity	At 40% Relative Humidity	At 60% Relative Humidity	At 80% Relative Humidity
R-2101	3.6	5.1	7.6	12.0	16.0
R-2102	3.3	4.8	7.0	11.0	15.0

SPECIFICATIONS FOR SHIPMENT

(Analyses in Percent on Dry Basis)

Grade	Al_2O_3 (Min.)	Na_2O (Max.)	SiO_2 (Max.)	Fe_2O_3 (Max.)	TiO_2 (Max.)	Combined H_2O	At 10% Relative Humidity	At 80% Relative Humidity
R-2101	90	0.80	0.12	0.10	0.02	9.0	3.3	15.0
R-2102	90	0.80	0.12	0.10	0.02	9.0	3.0	13.0

PARTICLE SIZE

Activated Alumina is offered in the following three standard particle sizes:

(1) Thru ½" on ¼" (2) Thru ¼" on 8 mesh

(3) Thru 8 mesh on 14 mesh

The advantages of activated aluminas as a desiccant include their low initial cost, their high capacity (see table above), and the fact that they are inert compounds in the presence of most chemicals. They may be used in contact with other chemicals without affecting them or the function of the activated aluminas themselves.

A major economy in the use of activated aluminas as desiccants stem from easy reactivation. Heating for a few hours at 175 to 200° C accomplishes complete reactivation. Activated aluminas in commercial use are usually placed in twin units with built-in heating elements. Thus one unit is in service while the second is being reactivated. In such a system plant operation can be continuous.

The wide variety of activated aluminas applications can best be described with a listing of its uses:

- *they dry gases:* air, nitrogen, hydrogen, oxygen, carbon dioxide, chlorine (some reaction), sulphur dioxide (slight decomposition of alumina), freon, ethylene, butane, by-product coke gas and natural gas.
- *they dry liquids:* pyridine, ethyl acetate, gasoline, coal tar derivatives, benzol, toluol, methyl alcohol, vegetable and animal oils, melted waxes, carbon tetrachloride.
- *they are used* to keep air lines free of water, to keep oil and gas lines dry.
- *they provide* dry air for transformer breather systems.
- *they have an affinity* for fluorine, highly effective in water defluoridization, and in HF alkylation.
- *they are effective* filtering media for turbine oils.
- *they are used* as catalyst carriers in petroleum refining.

Government Specifications: R-2101 Activated Alumina meets the rigorous requirements of joint Army-Navy Specification 169-D, later superseded by the military specification MIL-D-3716. Adsorptive capacity defined for Reynolds Activated Alumina is determined in accordance with methods prescribed by the above mentioned specification.

Shipping: Reynolds Activated Aluminas are offered in 100 pound lined burlap bags, in foil lined bags, in 400 pound steel drums, and in fiber drums. Minimum shipping quantity is 100 pounds. They are available in various particle size ranges.

Complete research and engineering services are available from Reynolds Metals Company to assist you in solving chemical, material or shipping problems. Samples and data sheets are available on Alumina Hydrates, Calcined Aluminas, Aluminum Dross and Aluminum Powders. Consult the Reynolds Office nearest you, or write direct to *Reynolds Metals Company, P.O. Box 1800-CR, Louisville 1, Ky.*

The Finest Products Made with Aluminas are made with REYNOLDS ALUMINAS

See "Circus Boy", Reynolds exciting dramatic series, Sundays, NBC-TV

Keep areas weed-free . . . avoid fire hazards

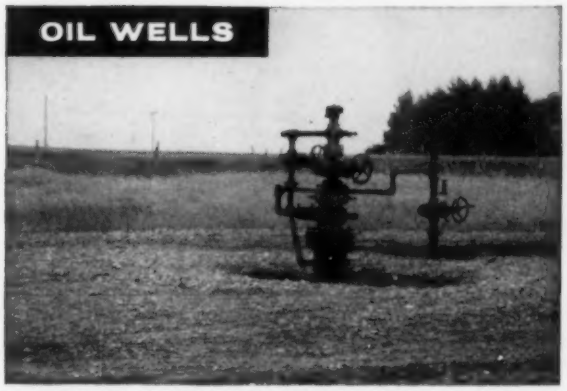
Spray Du Pont TELVAR® WEED KILLERS just once for season-long weed control

You can eliminate weeds and grasses that create fire hazards and that make maintenance difficult and costly. Just one spray of Du Pont "Telvar" controls weeds for a season or longer. "Telvar" kills weeds through the roots, then remains in the soil to provide residual action long after the initial spray is applied. Low dosages save you cost, handling and storage space. "Telvar" weed killers are non-corrosive to equipment, non-volatile, low in toxicity to humans and animals. For low-cost, long-term control of weeds, include "Telvar" in your maintenance program.

TELVAR®
Monuron and Diuron
WEED KILLERS

DU PONT
REG. U. S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY



Note the excellent control of weeds and grasses around this wellhead from just one application of "Telvar."

The treated area around this tank farm has remained weed-free for an entire season.

Along these pipelines, where maintenance is tough, one application of "Telvar" has kept the treated area weed-free for a year.

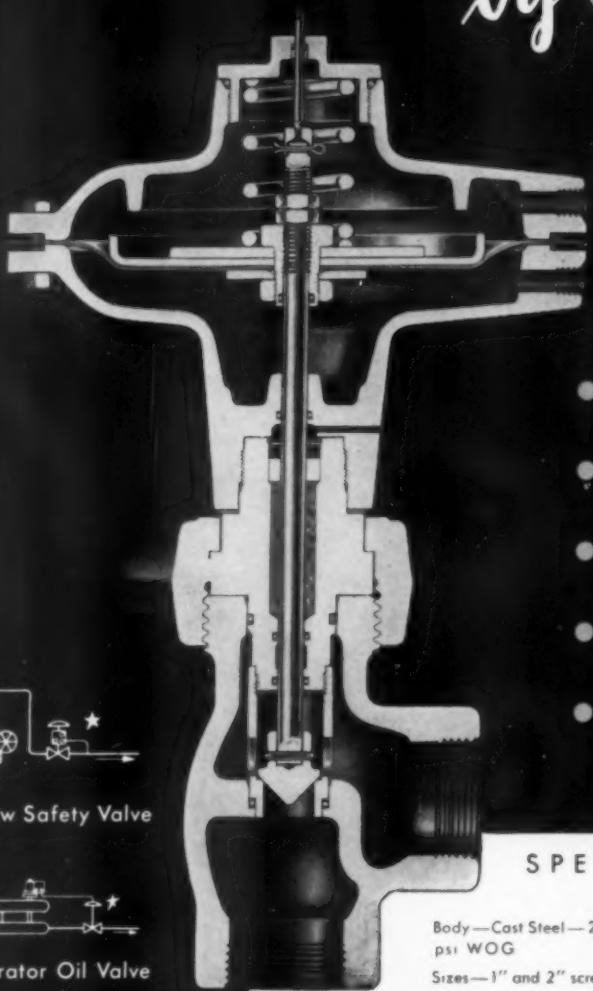
On all chemicals, follow label instructions and warnings carefully.

A *New* FIELD VALVE

by FISHER®

Series 125P

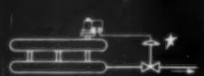
HIGH PRESSURE DIAPHRAGM CONTROL VALVE



- RUGGED CAST STEEL BODY GOOD FOR 2000 psi PRESSURE
- ONE INNER VALVE FITS ALL ORIFICES
- TOPWORKS INTERCHANGEABLE ON ALL BODIES
- DIAPHRAGM CASINGS SUITABLE FOR 50 psi OPERATING PRESSURE
- TOPWORK ACTION REVERSIBLE WITH NO ADDITIONAL PARTS

WRITE FOR BULLETIN O-125P

Hi-Low Safety Valve



Separator Oil Valve

Time Cycle Intermitter

SPECIFICATIONS

Body—Cast Steel—2000 psi WOG

Sizes—1" and 2" screwed angle or globe

Orifice Size—1" Body—¼", ⅜", ½", ¾" 2" Body—¼", ⅜" ½", ¾", 1"

Valve Cage—440 hardened St. Steel. (Tungsten carbide insert also available.)

Inner Valve—440 hardened St. Steel (Tungsten carbide tip also available.)

FISHER GOVERNOR COMPANY

MARSHALLTOWN, IOWA · WOODSTOCK, ONTARIO

LEADS THE INDUSTRY IN RESEARCH FOR BETTER PRESSURE AND LIQUID LEVEL CONTROL

FISHER *Since 1880*

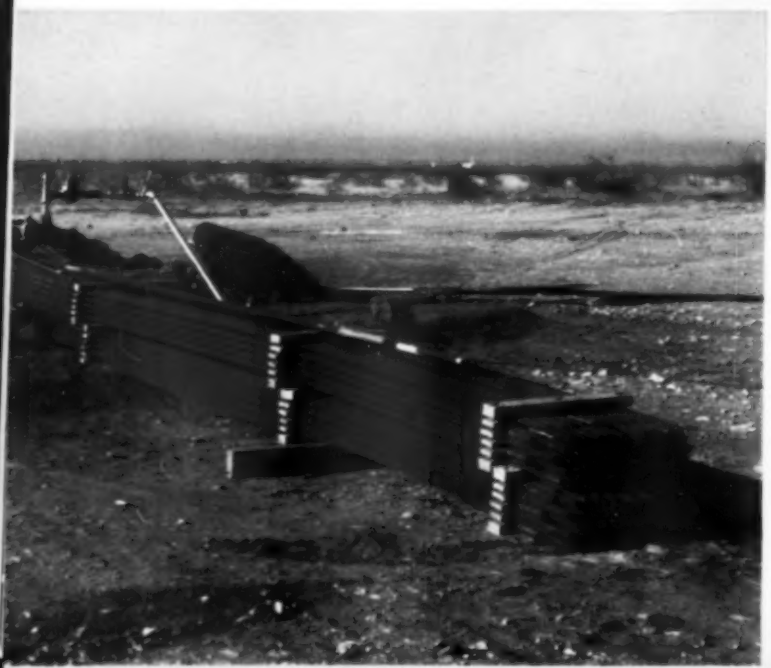
Producing

WITH J&L SUPPLY

The producer's best friend is J&L Supply. J&L stores, sales offices, and a vast network of resident salesmen in the United States and Canada provide active and stand-by service from flush production days through every subsequent phase of recovery. No other organization offers the producer so rich and convenient a source of practical experience and proven equipment.

The technical information, the interest, and the natural enthusiasm of J&L Supply men can be employed to advantage in the selection of casing, as in the design of special strings. J&L Supply service plus the exceptional quality of the product have established for J&L Seamless a remarkable record for satisfactory performance. Casing sizes from 4½″ to 13⅜″ O. D. Grades H-40, J-55, N-80, and P-110. T & C with API threads. Now also available in Buttress Thread and Extreme Line Joints.

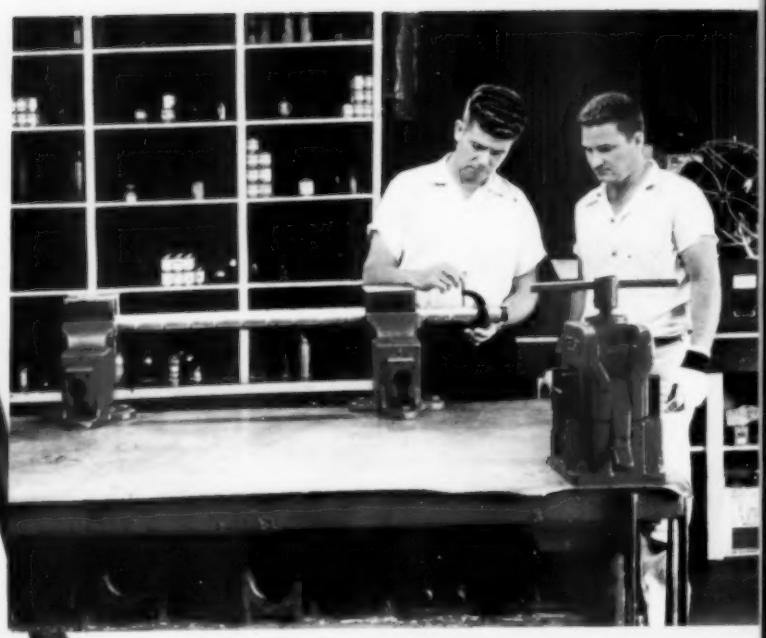
A well has greater promise of trouble-free production when both casing and tubing are J&L Seamless. J&L Supply men stand by 24 hours a day, eager and qualified to be helpful. API tubing 2⅜″ thru 4½″ O. D. Non-upset or external upset. J&L Integral joint in 2⅜″ and 2⅞″ O. D. J-55, N-80, and P-105 grades.



Further logical steps in safeguarding production — Axelson rods, an Axelson pump, and a Cabot unit. J&L Supply men have a vital stake in such a well. They tailor-assemble the pump to fit the job. The rods have been heat treated and normalized from end to end to guard against failure. The Cabot unit incorporates every device of known value for preserving the useful life and promoting the satisfactory performance of rods and pump.

Only a pumping unit with no moving parts, if such a thing were possible, could be more dependable than a Cabot. Cabot design and construction have one objective: steady production with minimum upkeep for the unit and the equipment it activates. Patented rubber tail bearing intercepts fatigue-creating stress. Sykes-cut herringbone gears, flood lubricated. Timken and Hyatt bearings. One-man crank achieves positive balance. Right, powered with a Century motor; a top performing team.

J&L Supply service adds to the downright pleasure of owning a Cabot anywhere in the United States or Canada. Not only are parts immediately available, but J&L men take an active, helpful interest in Cabot performance. Maximum polish rod loads from 3,000 to 32,000 lbs. Standard equipment: floor clearing subbase, V-belts, belt guards, adjustable slide rails. Left, Cabot's largest unit powered with Type "O" Lorain engine. API walking beam rating 33,160 lbs.; strokes to 144″; API peak torque at 20 S. P. M. 456,000 inch-lbs.



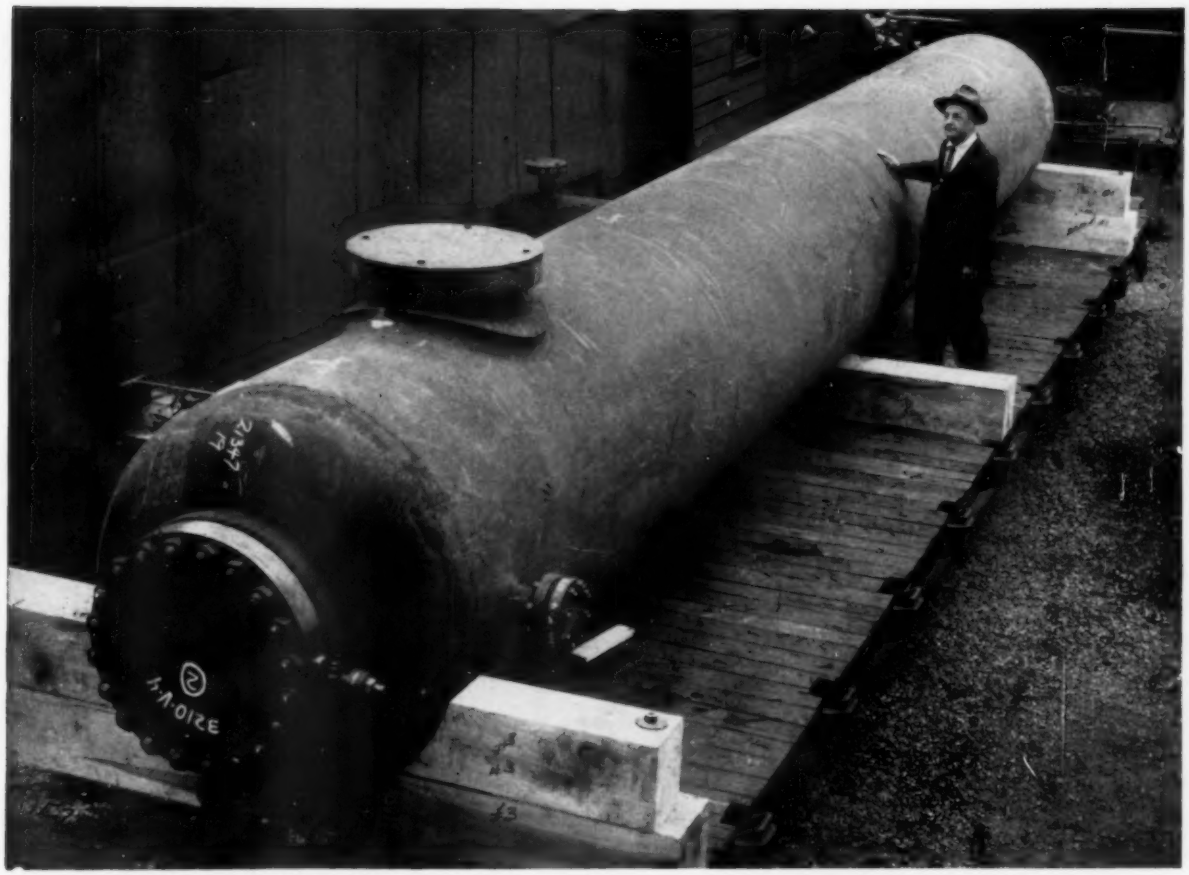
Pump shops are maintained by J&L Supply in the United States and Canada to tailor-assemble an Axelson pump for maximum production on any given job, and to keep that pump in perfect condition for the life of the well. "Never junk an Axelson" is a phrase coined in tribute to the efficiency and complete parts inventories of these J&L pump shops. Pictured here, the shop in Laurel, Mississippi, with J&L Supply men assembling an Axelson Sure-Seal solution to a local production problem.

Production everywhere gets a mighty lift from J&L Supply. Each store profits from J&L production equipment experience throughout the United States and Canada, and is stocked to provide one-stop service geared to the requirements of the area served. You'll enjoy doing business with an organization dedicated for more than fifty progressive years to the customer's logical objective: PRODUCING FOR MORE PROFIT. For real cooperation, get your J&L store on the telephone!

Jones & Laughlin

SUPPLY DIVISION – Tulsa

J&L — A GREAT NAME IN SUPPLIES



NEWPORT NEWS BUILT two 39'-7" horizontal gas scrubbers, such as this, for J. F. Pritchard & Co. They were made of ASTM-A212 Grade B fire box steel, with structural mesh steel interiors.

Gas scrubber made of 2⅞" steel

Newport News builds almost any type of pressure vessel and other heavy process equipment

Here is one of two horizontal gas scrubbers recently built for an operating pressure of 1800 psi at 300°F.

Newport News made both vessels from fire box steel, 2⅞ inches in thickness. We formed and automatically welded this steel into sections having a diameter of only 4 feet.

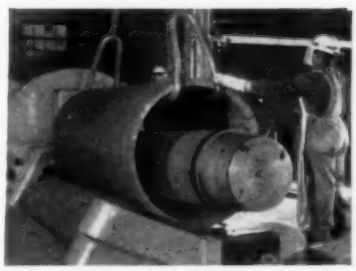
Rolling thick steel to this small diameter...no easy accomplishment, as you probably know . . . demonstrates the sort of jobs Newport News takes in stride.

Almost any type of heavy processing equipment is readily constructed by Newport News in a 225 acre plant comprising huge, fully equipped fabricating and machine shops, foundries, forge and die shops, heat treating and allied equipment as well as complete test facilities.

Newport News shop erection of fabricated units helps to speed assembly at your plant site.

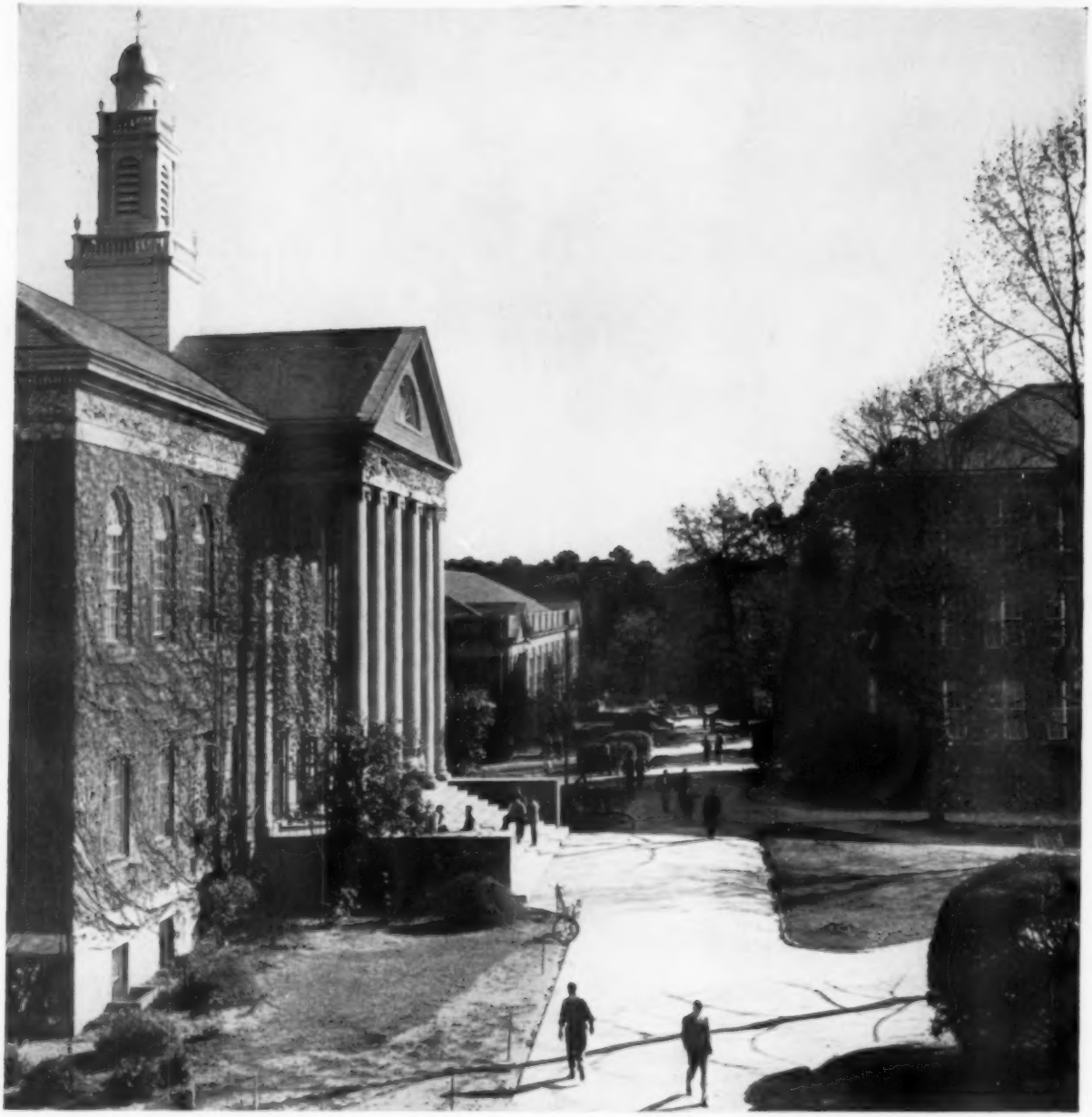
Get a bid from Newport News on your present or future projects. Get the benefit of specialized production techniques. Look over the many ways in which Newport News can help you . . . write for "Facilities and Products", a very interesting booklet. It's yours for the asking.

ENGINEERS Desirable positions available at Newport News for Designers and Engineers in many categories. Address inquiries to Employment Manager.



ROLLING 2⅞" STEEL for gas scrubbers. The steel, in a hot condition, was formed on the heavy bending equipment shown here. It will cold roll mild steel up to 3 inches thick, and will hot roll any grade of steel up to a thickness of 5 inches.

Newport News Shipbuilding and Dry Dock Company
Newport News, Virginia



"Business has a very particular interest in education . . . not only for the purpose of improving efficiency and profits, but more largely because it carries such a heavy responsibility toward our society. To discharge that responsibility we must have more and better educated people to give leadership, direction, inventiveness and understanding in our business world."

M. J. Rathbone, President, Standard Oil Company (New Jersey)

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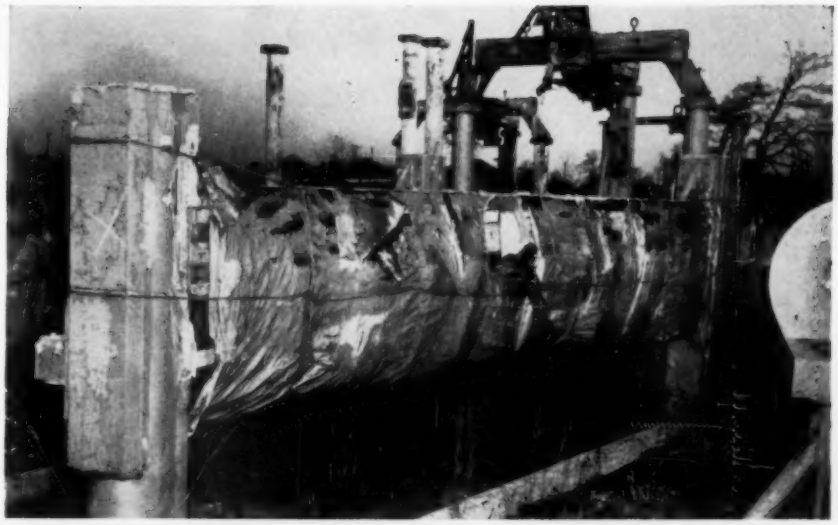
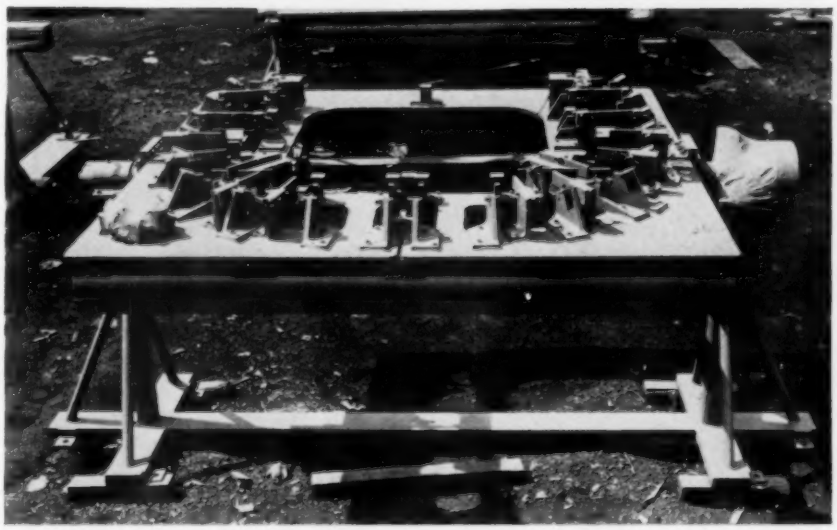


OLD METHOD FAILED

In the past, jigs and fixtures at Grumman Aircraft were protected by wrapping vital parts with several layers of kraft paper, then with masking tape, and finally spraying four to six coats of paint. For a fair-sized jig this would take three men 8 to 10 hours, and still leave legs and other parts exposed to weather. Too often, passers-by could not resist poking to "test" the wrapping, and break it open. But, even if unharmed, the labor for unwrapping the jig, removing rust from unprotected parts, and repainting often ran into hundreds of dollars per jig.



NEW METHOD SAVES TIME

Now a saving in time of up to 75% can be effected, according to Grumman, by treating permanently coated parts of jigs and fixtures with a wash primer and top coat, both based on BAKELITE Brand Vinyl Resins. For the machined parts that must remain uncoated in regular service, a strippable vinyl coating is applied. The jig is restored to service merely by cleaning the permanently coated areas, and removing the strippable coating from the other sections. Weather resistance of this coating system permits jigs to be stored outdoors without additional protection. One man can now spray 5 to 6 times as many items in the time formerly required by three men for the old wrapping method. The coatings used are formulated by *Carroll Products, Inc.*, Farmingdale, N. Y.

Low cost protection for

equipment stored outdoors

These photos dramatically show one way Grumman Aircraft Engineering Corp., Bethpage, N. Y., cuts operating costs by the use of modern specialized protective coatings based on BAKELITE Vinyl Resins. Similar long life and performance characteristics may be obtained for off-shore structures, masonry and other building materials, ships, as well as equipment used in the petroleum industry. For the names of formulators making coatings based on BAKELITE Brand Resins, write Dept. XP-128.

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They Say—

Journal's import stand

Dear Sir:

Recent editorials in my favorite trade journal seem to accept the idea of federal restriction of imports without debate.

I suggest that The Oil and Gas Journal will serve the national interest and the best interest of the petroleum industry in the long run by a review of its editorial policy.

The pressure for increased imports, curtailed domestic production, and lower prices comes from low-cost flush production in the Persian Gulf.

The cost of Middle East crude is low because the average production per well is nearly 5,000 bbl. per day, whereas the average production per well per day in this country is only 13 bbl. Further, a drilling program of 58,000 wells a year is required to maintain production and reserves in the United States, whereas in the Persian Gulf area 500 wells a year are sufficient.

In addition to their obvious immediate self-interest, those clamoring for control of imports argue that control is in the national interest because the United States should not be dependent on foreign sources of oil in emergencies. The closing of the Suez Canal is cited as a reason for maintaining standby capacity to produce.

This argument has considerab'e merit if the period of emergencies could be limited to less than 5 years, but for a longer period the argument appears to be invalid. For the United States is currently producing one-half of the free-world's supply of crude from less than one-sixth of the presently known, profitable, proven reserves. Therefore, since our presently known reserves are being used up much more rapidly than foreign reserves, a prudent national oil policy for the 5 to 10-year period ahead calls for rigid conservation of domestic reserves. Certainly the admission of imports without restriction will encourage conservation of domestic reserves.

Another argument is that shutting down of stripper wells causes a loss of reserves that cannot be recovered later economically. This argument would have more weight if the price of crude had been cut drastically under the pressure of low-cost imports. This has not happened and it is unlikely to happen in the face of the rapid growth of the world market for petroleum.

The philosopher Alfred North Whitehead once criticized American business because it was shot through and

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LINK-BELT's answer to endurance demands on roller chain

THIS IS FR. * By compressing the metal around pitch holes, Link-Belt greatly strengthens the critical sidebar areas most vulnerable to fatigue failure. This original development is the result of Link-Belt roller chain research and unequalled depth of oil field experience. FR is standard on Link-Belt oil field roller chain.

* U.S. Patent No. 2,517,497

Greater sidebar Fatigue Resistance means greater dynamic strength... increased chain endurance

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- PRE-STRESSING for load bearing uniformity.
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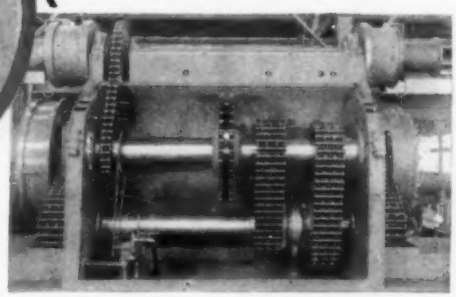
- SHEPHERD'S CROOK COTTERS that won't shake loose.
- DOUBLE BOXING—most effective in the field.

For full information on them all, ask any leading supply store for your copy of Link-Belt Catalog 2780.



NATIONAL SUPPLY 160-S DRAWWORKS incorporates Link-Belt FR roller chain—supplied as original equipment.

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A competitively priced stainless steel seat for routine pumping.

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TOUGH

LONG LIFE

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through with short sighted motives. I urge the editors of The Oil and Gas Journal take a long look at the merits of federal control of imports.

Francis F. Campbell
Tulsa.

Union Oil in Paraguay

Dear Sir:

I would like to call attention to an error in a story on page 103 of the July 1 issue of The Oil and Gas Journal: "Paraguay Opened: Grants first concession along border of Bolivia" which begins with the sentence: "Paraguay's first oil concession has been granted . . . "

Union Oil Co. of California had a concession in Paraguay from 1945 to 1950. We quit after five dry holes.

W. R. Moran
Senior Geologist
Union Oil Co. of California
Los Angeles.

A well is a well is a well

Three cheers for Henry D. Ralph's "A Well Is a Well Is a Well" in the July 1 issue (Journally Speaking, p. 73).

As we all know, many definitions in applied science are horribly inexact (even some of our most cherished terms of devious Greek origin). Certainly, we should make occasional improvements in geological and engineering terminology. Meanwhile, a certain healthy skepticism of fixed practice among our own "minutia-minded purists" is to be encouraged. So thanks for giving a wide circulation to Frank Parker's choice bit of nonsense.

Louis Christian
Los Angeles.

P. S. If you try to tell us a heptcat is a well with six bottom locations, I'll argue!

Graceful as a "chucklehead"

"Some oil and gas companies go about their public business with all the ease and grace of a set of chuckleheads.

"It was bad enough when a group of these in their zeal to have Congress approve the exemption of natural-gas producers from direct federal regulation in 1955 went so far in their methods as to lay themselves open to federal prosecution . . .

"Yet the matter grew worse when the propaganda group that plugged for the gas bill claimed income-tax exemption for contributions to an industry-wide 'educational' campaign. This group spent more than $1,750,000 during 15 months ending in March 1956 lobbying for the bill—and then had

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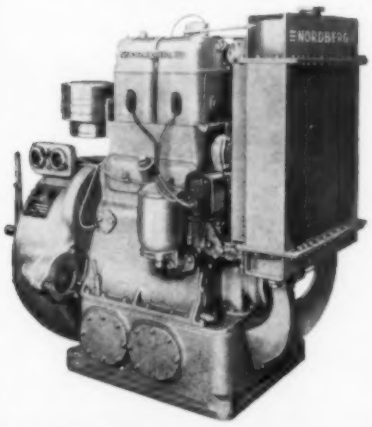

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NATURAL GAS, GASOLINE and DIESEL ENGINES up to 45 H. P.

In the low cost medium speed POWER CHIEF engines you get all the design, construction and fine quality that has made Nordberg engines famous throughout the world for over 50 years.

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Such FEATURES as these make POWER CHIEF the best buy: Removable wet cylinder liners • Valves in head • Replaceable valve guides • Special alloy inserted exhaust seats • Positive full pressure lubrication • Internal ventilation bars entry of dirt • Crankcase and all other vital parts fully sealed • Oil heat exchangers maintain proper internal temperatures at all loads • Safety approved, enclosed heavy flywheel smooths out fluctuating loads • Fram oil filters • Vortox oil bath air cleaners • Wico & Bosch magnetos • Twin Disc clutches • Murphy safety shut-down devices • No extra added costs for these when you buy.

Nordberg POWER CHIEF engines are now sold and serviced by Fred E. Cooper, Inc., with almost 40 years of specialized experience in the application and operation of oil field engines.

One source for engines, parts and service — a Cooper sold POWER CHIEF must operate as specified.

COOPER portable well servicing, workover and drilling equipment

Self powered and self propelled machines.

Skid units with positive and full air friction clutch.

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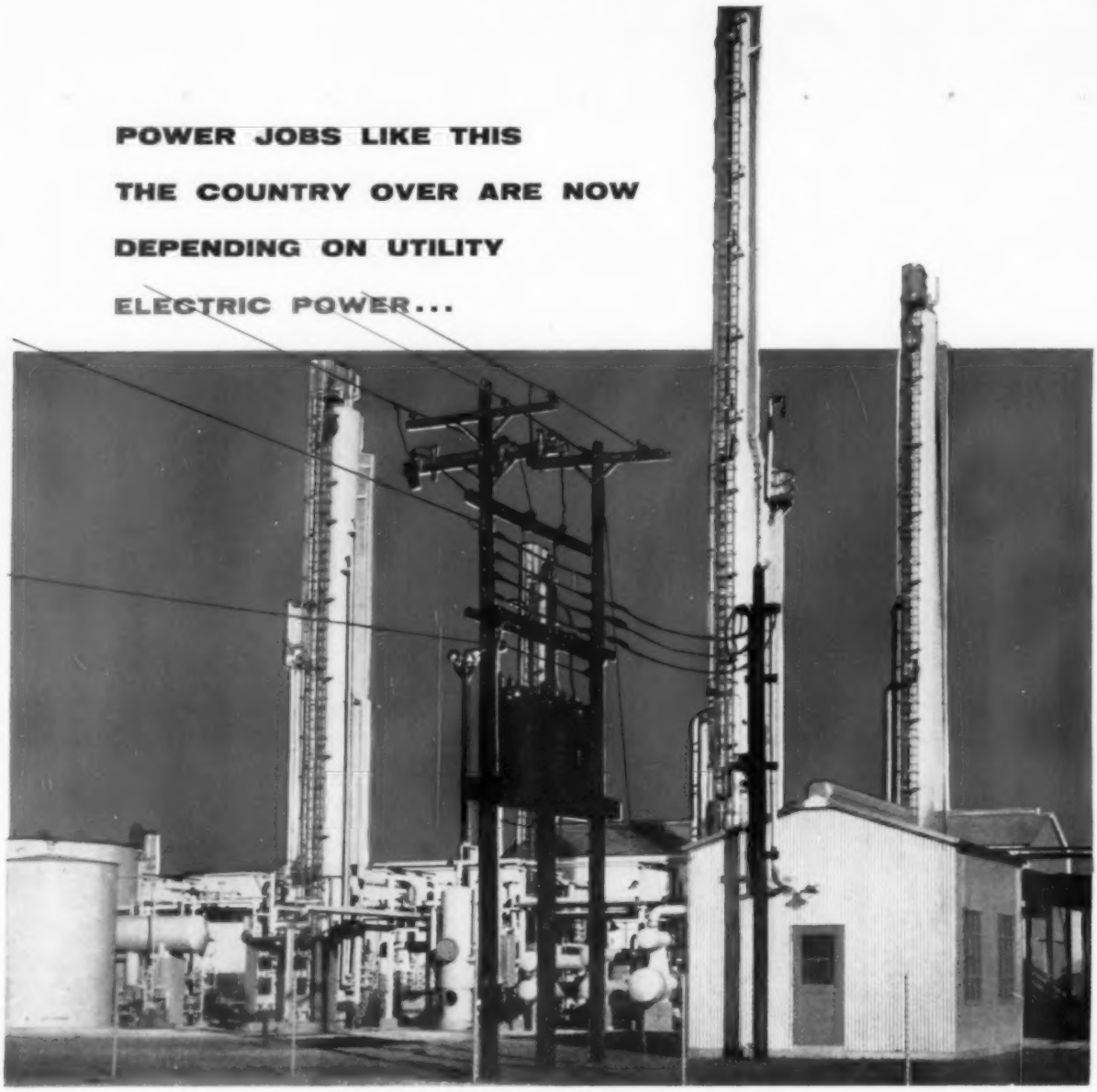

Progressive Management is taking a second look

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PETROLEUM ELECTRIC POWER ASSOCIATION

P. O. BOX 2771 DALLAS, TEXAS

the burglar's nerve to try to write it off as 'educational' expense. The Treasury Department turned that appeal down in a hurry."

Editorial in the El Dorado, Kans., Times.

Corpus Christi relocated

Dear Sir:

Please check page 189 of your July 1 issue. I don't think Nueces County will appreciate the way you have relocated the city of Corpus Christi. Maybe if you would offer to pay a portion of the cost to move it back they would forgive you!

I realize your proofreaders have a lot to cover—but moving a big city 40 to 50 miles—tsk, tsk!!

Robert M. Gordon
Houston.

A public-relations formula

"There is nothing mysterious about building and maintaining a good reputation. First, it requires the use of efficient business practices and progressive operating methods. Second, it's a common sense matter of treating people as you yourself want to be treated. The same principles that govern our individual relations in a community also govern those of our company. For example, we believe in:

"... **Paying our bills** quickly and on time,

"... **Keeping our property** and equipment in safe condition,

"... **Honoring our** agreements,

"... **Making reasonable** demands for service from our suppliers,

"... **Providing news** and information which is not of a private nature to people and publications who are interested in us.

"There is nothing complicated about this. It's a built-in part of our daily business life. It is exactly as it should be."

Editorial in the De Taylor, magazine of Delhi-Taylor Oil Corp.

Pipeline Ownership Debate

"If oil companies were not permitted to own or operate pipelines, presumably the common carrier pipelines would be limited strictly to the field of transportation, and interstate lines would be controlled as in the case of interstate gas pipelines. Such a step would be of extremely serious consequences for the independent producer but, what is more serious from the viewpoint of national security and economy, such an arrangement could drastically curtail oil exploration and development in the United States.

"With the pipelines limited to the

There are no higher quality standards in industry than those that govern the material, design and manufacturing of Harrisburg Pipe Flanges and Couplings. Are such high standards necessary? Users of Harrisburg products are convinced that they are because maintenance is a vitally important factor today with labor costs at an all-time high.

Harrisburg Drop-Forged Pipe Flanges are made to A.S.A. Specifications in threaded, butt welding, slip-on welding, Van Stone and blind types. Accurately controlled analysis, machining, and inspection assure uniformity that is important to oil field, utility and industrial users.

Harrisburg Seamless Steel Pipe Couplings are made to A.P.I. and A.I.S.I. Specifications and threaded by a special process, developed by our engineers, which produces threads of unsurpassed accuracy in form, height, angle and lead. Threads are electro-galvanized to prevent seizing.

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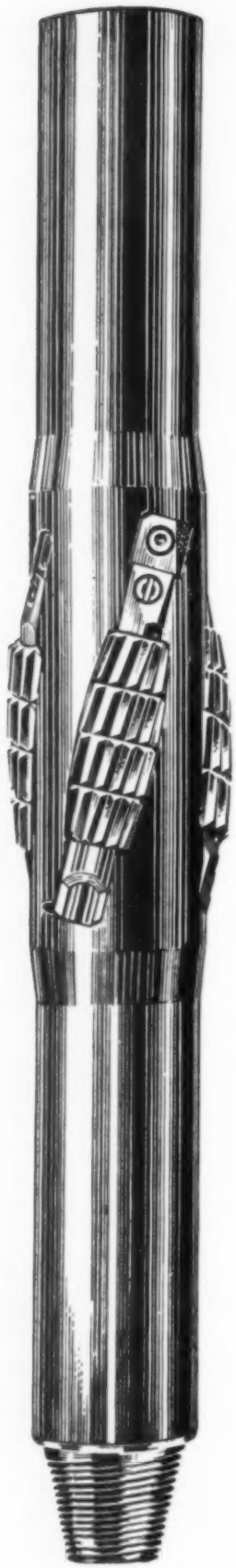
WORTHINGTON CORPORATION, Oil City, Pennsylvania



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functions of common carriers, controlled and regulated by a federal agency, it is probable that no substantial pipeline construction could take place connecting a new field with a trunk line until such field had been developed to the point where sufficient oil reserves were actually proven to guarantee the amortization of the full cost of the line plus whatever profit the federal agency might authorize. Under present conditions, . . . oil companies will build lines in reasonable expectation of favorable developments instead of waiting until such developments have actually been accomplished."

Russell B. Brown, general counsel, Independent Petroleum Association of America, in a letter to Senator Joseph C. O'Mahoney.

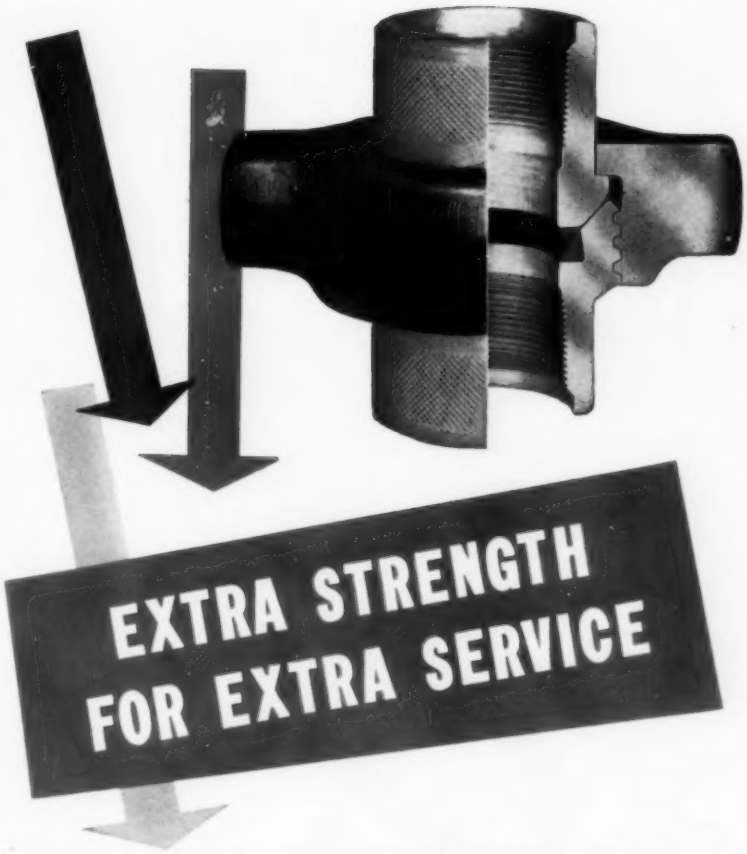
CALENDAR OF EVENTS

AUGUST

1-3	Rocky Mountain Mineral Law Foundation, third annual institute, Montana State University, Missoula, Mont.
19-20	North Dakota Oil and Gas Association, annual meeting, Bismarck, N. D.
26-28	Seventeenth annual Appalachian Gas Measurement Short Course, West Virginia University, Morgantown, W. Va.
28-30	Instrument Society of America, International Symposium on gas chromatography, Kellogg Center, Michigan State University, East Lansing, Mich.

SEPTEMBER

3-5	Pacific Coast Gas Association convention, Fairmont and Mark Hopkins Hotels, San Francisco.
5-7	New Mexico Geological Society, eighth annual field conference, southwestern Colorado.
8-13	American Chemical Society, 132nd national meeting, New York City.
9-10	Independent Natural Gas Association of America, annual meeting, Shamrock Hilton Hotel, Houston.
9-11	American Institute of Electrical Engineers, petroleum industry conference, Sheraton Hotel, Philadelphia.
11-13	National Petroleum Association, fifty-fifth annual meeting, Traymore Hotel, Atlantic City, N. J.
19-21	Rocky Mountain Oil Show, fairgrounds, Casper, Wyo.
22-25	American Society of Mechanical Engineers, petroleum mechanical engineering conference, Mayo Hotel, Tulsa.
23-25	American Society of Mechanical Engineers, fall meeting, Statler Hotel, Hartford, Conn.
26-27	Western Petroleum Refiners Association, Rocky Mountain regional technical-industrial relations meeting, Henning Hotel, Casper, Wyo.
26-27	Mid-Continent Oil and Gas Association, Louisiana-Arkansas division, Roosevelt Hotel, New Orleans.
30-Oct. 2	American Oil Chemists' Society, 1957 fall meeting, Netherland Plaza Hotel, Cincinnati.



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The best example of this is the use of Weco Unions in service company operations. Under high pressures and volumes, under shock, surge and vibration, Weco's ball and cone seat holds a seal that refuses to leak. The strong Acme threads in the female sub and wing nut make-up easily—break-out quickly—time and time again without damage or distortion. The tough wing nuts, sturdier sub ends with heavier wall construction, withstand the toughest treatment—on job after job—and come back for more.

This extra service from extra strength makes Weco the best union buy in the oil country today. Get them at supply stores everywhere.

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The longest, surest gripping surface of any hand slip.

No wonder Byron Jackson makes the finest hand slips. BJ makes the dies and inserts that provide the "teeth" in 95% of the slip elevators, spiders and power slips in use throughout the world. BJ is also the world's leading manufacturer of tong dies.

BJ inserts are used in extremely heavy-duty equipment. (BJ's new combination Elevator-Spider, for instance, can safely hold *500 tons* of casing!) BJ Hand Slips, with their exclusive extra-long gripping surface, have the same kind of rugged holding power.

With 17½" BJ Hand Slips you have the longest, safest, surest possible grip on your drill string – without employing power equipment. BJ slips spread the load over a greater area. They won't damage your pipe.

BJ Hand Slips are well balanced and easy to handle – they keep crew fatigue at a minimum.

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WATCH BJ FOR THE NEWEST

OCTOBER

1-2 Texas Mid-Continent Oil and Gas Association, thirty-eighth annual meeting, Texas Hotel, Fort Worth.

2-4 Golden Trend Oil Show, Pauls Valley, Okla.

6-9 Society of Petroleum Engineers of American Institute of Mining, Metallurgical, and Petroleum Engineers, fall meeting, Adolphus, Baker, and Statler Hilton Hotels, Dallas.

7-9 National Electronics Conference, thirteenth annual meeting, Hotel Sherman, Chicago.

7-9 American Gas Association, annual convention, Kiel Auditorium, St. Louis.

7-11 American Institute of Electrical Engineers, fall general meeting, Morrison Hotel, Chicago.

10-11 California Natural Gasoline Association, thirty-second annual fall meeting, Huntington-Sheraton Hotel, Pasadena.

10-12 American Society of Mechanical Engineers, American Institute of Mining, Metallurgical & Petroleum Engineers, fuels conference, Chateau Frontenac, Quebec.

13-15 American Association of Oilwell Drilling Contractors, seventeenth annual meeting, Mayo Hotel, Tulsa.

13-19 OIL PROGRESS WEEK.

17-18 American Institute of Mining, Metallurgical, and Petroleum Engineers, Southern California petroleum section, fall meeting, Biltmore Hotel, Los Angeles.

17-19 Four Corners Geological Society, second field conference, Gallup, N. M.

18 American Institute of Chemical Engineers, South Texas section, twelfth annual technical meeting, Moody Convention Center, Galveston, Tex.

20-22 National Association of Oil Equipment Jobbers, annual convention and trade show, Hotel Peabody, Memphis.

24-25 Western Petroleum Refiners Association, regional technical-industrial relations meeting, Rufus Garrett Hotel, El Dorado, Ark.

25 Natural Gasoline Association of America, southern regional meeting, Washington-Youree and Captain Shreve Hotels, Shreveport.

27-29 Independent Petroleum Association of America, annual membership meeting, Statler Hilton Hotel, Dallas.

31-Nov. 1 American Association of Petroleum Geologists, Mid-Continent regional meeting, Cimarron Ballroom, Tulsa.

NOVEMBER

3-8 Society for Nondestructive Testing, second international conference, Hotel Morrison, Chicago.

6-8 Gulf Coast Association of Geological Societies, seventh annual convention, Roosevelt Hotel, New Orleans.

6-8 Society of Automotive Engineers, national fuels and lubricants meeting Hotel Statler, Cleveland.

11-14 American Petroleum Institute, thirty-seventh annual meeting, Conrad Hilton Hotel and Palmer House, Chicago.

22 Natural Gasoline Association of America, Panhandle Plains regional meeting, Herring Hotel, Amarillo, Tex.

DECEMBER

1-3 Interstate Oil Compact Commission, annual meeting, Tulsa.

1-6 American Society of Mechanical Engineers, annual meeting, Statler Hotel, New York.

8-11 American Institute of Chemical Engineers, annual meeting, Conrad Hilton Hotel, Chicago.

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This map shows the location of over 30 chemical plants now on the Ohio River including Columbia-Southern's plant at New Martinsville, West Virginia.
New Martinsville
West Virginia
OHIO RIVER
COLUMBIA
LIQUID CHLORINE
COLUMBIA-SOUTHERN

Pioneering America's Chemical River

A multi-billion dollar array of chemical plants has sprung up—chiefly in the last decade—along the banks of the Ohio River. Initiating this chemical boom in the upper Ohio Valley was Columbia-Southern's chlorine-caustic soda plant erected in 1943 at New Martinsville, West Virginia.

Many factors influenced the choice of this site—Columbia-Southern's geological research which confirmed the presence of huge salt deposits at practicable depths; plentiful supplies of West Virginia coal; the proximity to industrial centers; and, of course, the capacity of the Ohio to carry more than twice the tonnage handled by the Panama Canal.

The presence of a successful plant in an area frequently does more than anything else to attract others. Just as Columbia-Southern's Corpus Christi plant spurred the development of the great Gulf Coast chemical industry, so the New Martinsville plant sparked growth along the upper stretches of the Ohio. Today, from Pittsburgh to Paducah, the Ohio truly deserves the title of America's Chemical River, flowing unvexed to many markets.

This pioneering spirit pervades in every field of Columbia-Southern operations, producing continued developments and improvements in which its customers are first to share.

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The OIL AND GAS JOURNAL

TULSA, OKLAHOMA

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•

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JOURNALLY SPEAKING

Funny Coincidence Dept.

IF IT'S TRUE that imitation is the sincerest flattery, our favorite oil publication frequently gets some very high flattery from some of its competitors. In fact, it would appear that more than one oil writer not on our payroll considers us his favorite oil publication, too.

Since our long-time policy has been to come out first with the most of the best and be a source book for the entire oil industry, we are quite accustomed to seeing our stuff picked up, rehashed, and served up again by others. Most of the time we don't mind this too much, because ever since the invention of the printing press editors have been cribbing from each other when they get hard up for original material.

Now and then, however, this sort of thing gets a little irritating, particularly when our specialties of the house are offered on another menu simply warmed up and without even a change of sauce or garnish to disguise the leftovers.

About the rawest case was a couple of years ago when another magazine, using a photo-offset process, reproduced (without credit or identification) several Journal pages in facsimile—complete with our own original typography, headlines, and artwork.

We jumped on that publisher hard, and on a few other occasions we have reminded editors that the traditions of the craft are to do a more thorough job of disguising when rewriting lifted material. Most of the time, though, we keep quiet and trust that our readers will know that they saw it first in the Journal.

The man on our staff who probably gets the most of this highest form of flattery is Frank Gardner, our exploration editor. His signed page of personal observations and comments and the other articles on geology and oil finding that he and his staff assemble every week have established a well-warranted reputation for being in the van in pointing the highlights and interpreting the trends in the enigmatic business of figuring where to drill. Understandably he is widely quoted—but all too frequently without credit.

For some time now Frank has been slightly amused to note that whenever he prints a particularly good piece, some competing publication follows along a month or two later with a rehash of same souped up like something new and exciting. But he got really piqued when some of his pet phrases and original expressions found their way into others' print. The coincidences were becoming unfunny.

Now our exploration editor is a Ph.D. in geology (what other publication can make that claim?) but he also is a nasty schemer with a perverted sense of humor. So he laid a trap. In our April 15 issue he ran a piece about the Palo Duro basin in the Texas Panhandle. His headline said that the prophet was going out on a limb, and this was *double entendre* because his secret prophecy was that somebody else would be caught out on a limb.

Frank knew that near the city of Amarillo there is a geological high that has no name anywhere in the literature. So on his map he slyly christened it the "Armstrong anticline" in honor of the Journal's news editor, Ted Armstrong.

Then he waited, with the patience characteristic of a geologist. True to his prophecy, almost exactly 2 months later another publication came out with a big splash about the Palo Duro basin. Frank was flattered that the principal facts assembled and main conclusions drawn by this other writer coincided quite neatly with his own.

But the funniest coincidence was the map. Yup, right smack dab in the middle of it, big as life, was the "Armstrong anticline."

There's a saying that flattery will get you nowhere. But our News Editor is convinced that the saying works in reverse where the imitation type of flattery is concerned. Look where it got him!

This sincerest form of flattery not only got Ted Armstrong's name perpetuated in geology but got it printed in big type in a rival publication.

—*Henry D. Ralph.*

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Ending the suspense on imports will be a relief

THE administration's policy decision on oil imports will please some and displease others. But a definite decision at least has the virtue of ending the suspense. The uncertainty as to government action during the past couple of years has been a serious impediment to industry planning.

This is no minor consideration. Ending the suspense is just as important to those who want imports high as to those who want them low. Every segment of the industry must make long-range plans and base business decisions on estimates of future trends.

And nobody, here or abroad, can plan intelligently without some indication of what may happen to this major hunk of the world's oil business. For at the current rate of around 1½ million barrels per day, U. S. imports represent some 17 per cent of the domestic market and 19 per cent of free-world foreign production.

KNOWLEDGE of what imports are likely to be is more important in planning than whether the prospect pleases the planners. Those standing to be hurt can make plans for the worst. With the uncertain factor of government action pinned down, import trends can be forecast and all segments of the industry can start making adjustments.

Importers, foreign producers, tanker operators, and exporting countries would benefit by knowledge of what U. S. imports policy is going to be, whether the policy is favorable to them or not.

In this country the uncertainty about imports hangs like a cloud over plans for refinery location and expansion, construction of crude and products pipelines, and market-development programs.

It is a question mark in all forecasting of demand, production, drilling, wildcatting, and leasing. States can't anticipate their revenue from production taxes. Banks can't intelligently finance oil operations.

The growth pattern of natural-gas markets depends in large measure on the trend of future oil imports. So does the embryonic shale-oil industry. So does planning for national defense.

As things stand now, pipelines don't know whether or not to extend to remote areas and unconnected wells. Producers don't know whether or not to drill for potentially high-cost oil. The payout on secondary-recovery and other conservation measures is in doubt.

In fact, every problem in the oil industry runs into a dead end at the question of how high imports are going to be.

IN THIS RESPECT, almost any decision is better than continued uncertainty. Even a definite policy of no restrictions, for example, would enable the industry to operate on forecastable competitive conditions without trying to guess what Washington might do.

In any case, every segment of the industry would have some basis for planning its future—even if that future looks like liquidation.

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The OIL AND GAS JOURNAL

July 22, 1957

American motorists jamming today's highways at least can skip one worry: Gas quality.

Refiners are a jump ahead of Detroit:

... Octanes Key to '58-Model Changes

George Weber and John P. O'Donnell

THE OIL INDUSTRY has done it again! Refiners have jumped octanes ahead of current car requirements.

This is the gasoline picture at mid-year:

Octane ratings are high enough to satisfy even the highest requirement 1957 passenger car models.

Stepped-up premium gasoline and third-grade superpremium with 100 research-octane ratings or better are available over nearly three-quarters of the nation.

When the factor of altitude is considered, cars requiring 100-plus R.O.N. are satisfied in nearly every major marketing area except the Pacific Coast.

The pressure that brought about this new spurt in top octanes came not from Detroit but from within the oil industry.

Detroit watches . . . These gasoline trends are not going unnoticed in Detroit.

Passenger-car manufacturers take a long look at octane ratings at this time of the year. Their decisions on how far to push compression ratios for 1958 models will be based on two factors: Ratings of both regular and premium gasolines; their distribution throughout the country.

The best guess now is that 1958 models will have compression ratios averaging 9.5:1. This is about one-half a compression number ratio higher than current models. It is roughly the same increase made in 1957.

By rule of thumb an increase of one-half a unit in compression ratio calls for roughly one higher research-octane number in fuel quality. The jump of one-half a compression ratio in the 1957 models has been matched during the past year by a weighted average increase of one research-octane number in regular grade, and 1.2 R.O.N. in premium. Not counted in these octane averages are the third grades now sweeping the country.

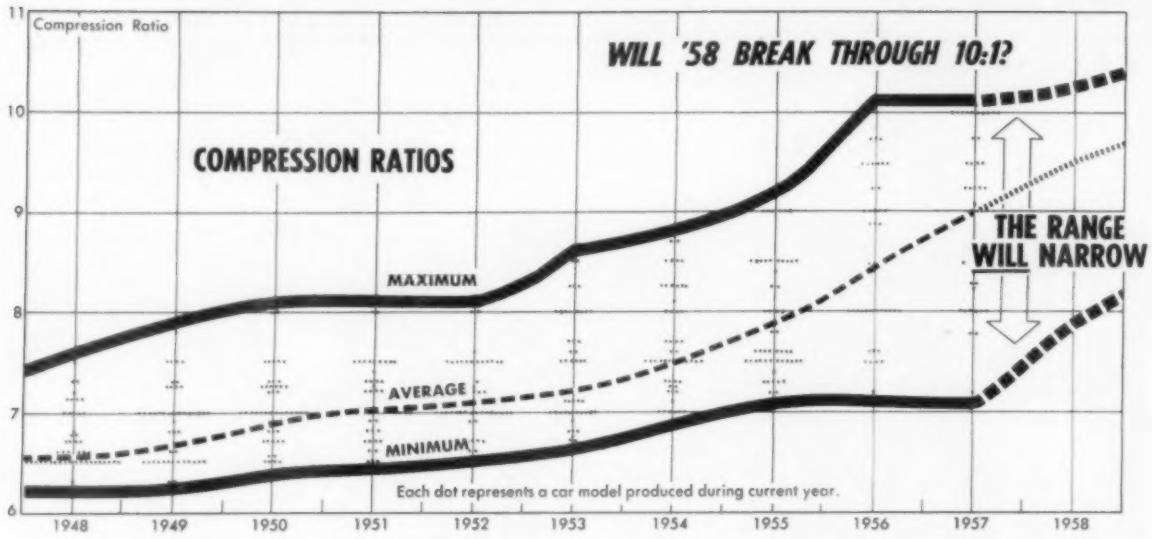
The projected rise for 1958 from the present 9:1 to 9.5:1 in compression ratio would appear to call for another increase of one research-octane number in fuels. This will come about by next summer if the oil industry maintains its present lead on car requirements.

Other trends . . . Some other developments are brewing in Detroit which will affect refiners' future plans.

It is conceded that the range between highest and lowest compression ratios will narrow next year.

This will occur mainly by raising the lower ratios (chart, p. 44). A few companies found in 1957 that they were not taking full advantage of regular octanes. They will close the gap next year.

It is still too early to foresee what may occur in the high-compression ratio range. Competition promises to be rough in the automotive field next year. It will be no time to produce a



car whose octane requirement is out of joint with available fuel quality. So, look for more models to edge up to the 10:1 class.

But who, if anyone, will jump much higher is still questionable. Hence, no marked stepout above 10:1 is anticipated for 1958. Plans could change, for decisions on this particular modification are among the last to be made. It is probable that many manufacturers will not make their moves until later this summer.

Premium vs. regular . . . The coming year may see the turning point in dominance of the automotive-fuel market by regular gasoline.

It well could see sales of premium grades surpass those of regular. This change has been developing over the past 2 years.

Here's how it has occurred: The spread of compression ratios has widened in the last 2 years. This was brought about by bold jumps in the top compression ratios. Strangely, despite corresponding rises in average octanes of available motor fuels, the few models with minimum compression ratios and octane requirements did not keep pace.

The result of this upward move in higher-requirement brackets has been that sales of premium have risen faster than sales of regular. The development is expected to cause an increase of 1 per cent per year in demand for premium at the expense of regular consumption.

The ratio of premium to regular-grade purchases for passenger cars alone is considered nearly equal today. This 50-50 breakdown results when all bus, truck, farm, and other off-the-road demand is stripped from total consumption. Passenger-car demand itself appears certain to favor premium or superpremium third grades over regular.

Statisticians, however, can't say with certainty whether more premium than regular-grade motor fuel is now being sold to passenger car owners. But they do say this likely could take place in 1958.

Power and gadgets . . . With a stiff competitive year coming up, the automotive industry is going to use all the tricks it can to capture buyers' fancy. Individual makers will emphasize power and gadgets.

Recently the industry announced it would forswear talking about speed and power. But horsepower is still firmly expected to rise in the 1958 models. The unweighted average power of 1957 models is 232.8 hp. Next year it should approximate 250.

It appears, however, that increased efficiency gained from higher compression ratios still will be funneled into greater performance and power-absorbing auxiliaries.

Does the current craze for foreign cars mean a reversal in this power-performance race? Perhaps it will eventually, but not in 1958. The upsurge in sales of imported cars which get high mileage is well documented this year. Many foreign makers are working with 6-month backlogs, while dealers' stocks of American cars are building up.

Although the percentage of foreign cars on our roads still is extremely low, their numbers are impressive. American manufacturers will make their first big countermove next year to protect their domestic market. They will act through foreign affiliates.

Ford has been selling its English car in this country since 1949. Next year General Motors will bring in its English Vauxhall and its German Opel. Sales will be handled through present dealers. Studebaker-Packard intends to handle Mercedes sales.

Meanwhile, the success with power steering, power brakes, power windows and other motoring aids points to higher production of the gadgets next year. These mean less energy transmitted to the rear wheels. But until the American public shows a firm desire for more economy, the luxury and power trend will continue.

Fuel injection . . . Talk of fuel injection so far this year has been something less than brisk.

Chevrolet's optional injection system is considered only a mixed success. Price has been one deterrent. Performance has been another. Improvements are promised, though, to remove this obstacle to greater use.

Next year, Cadillac will offer fuel injection as optional equipment on one or more models.

There is still widespread talk in the industry of a move to fuel injection by Ford, but no definite word has come from the company yet. While fuel injection is conceded to be coming, it doesn't appear that 1958 will mark any significant breakthrough. There still remain many improvements before the system is ready for widespread adoption.

Gas turbine . . . Talk of the gas turbine taking over the automotive field has died down even more this year.

Sincere doubts exist among many that this power unit ever will make a serious bid in passenger cars for many years to come—if ever. Major hurdles remain in response, noise level,

and fuel economy, particularly while idling.

A recent discussion of the gas turbine presented by General Motors engineers before the Society of Automotive Engineers revealed turbines are now ready for application in heavy automotive and military vehicles. Significantly, no mention was made of its possible inroads into the passenger-car field.

Octane picture . . . Now for a look at today's octane picture and how it fits 1957 car requirements.

So far this year there have been two significant octane developments:

First, the weighted average octane of premium shot up 0.9 number for the nation as a whole. The jump occurred in the first 6 months of 1957. It is much sharper increase than occurred in the same period last year, and it matches the rate of 1955's record increase. That year the average moved up 1.8 R.O.N. between January 1 and December 31.

Second, the West Coast gives evidence of catching up with the rest of the nation in octanes. All of the six coastal cities except San Francisco sampled in the Ethyl Corp. survey show increases of 1.0 to 1.2 in their average premium octanes since the first of the year.

The requirements . . . The degree with which today's motor-fuel quality satisfies 1957 model cars is the basis for the expected higher requirements in 1958.

Composite curves in the accompanying chart show trace knock and light knock of this year's cars. They illustrate the comfortable position held by petroleum refiners.

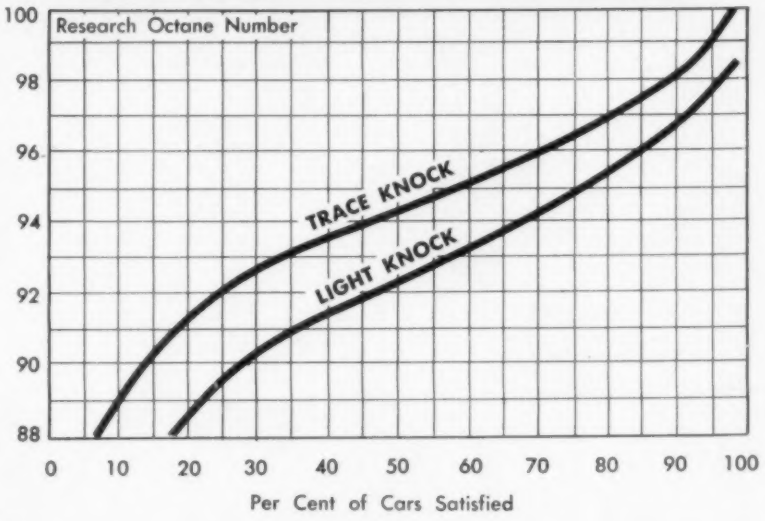
These curves are derived from extensive road tests conducted by Ethyl Corp. They weigh the effect of projected sales of 36 of the 1957 models based on actual sales to April 1.

Requirements for trace knock are obtained on level road, at sea level, with equilibrium engines whose deposits have stabilized under normal driving conditions.

Note that about 98 per cent of all 1957 models are estimated to be satisfied with 100 research-octane motor fuel. This does not mean, however, that drivers of the remaining 2 per cent are necessarily aware of knock.

Ethyl has found that knock recognition among drivers varies widely. By and large, most do not note any ill effects when their cars are in the trace-knock range. Hence, the second curve is added to show octane requirements to suppress light knock.

OCTANE REQUIREMENTS OF 1957 ENGINES



This curve is derived statistically from the trace knock data obtained in road tests.

The satisfaction of 1957 models as far as owner awareness is concerned actually falls somewhere between the two curves, depending on perception. This would indicate that 95 per cent of 1957 models are satisfied by motor fuels with research-octane ratings on the order of 99 numbers.

The fact that these curves are based on commercial gasolines is to be stressed. Road tests using reference fuels show lower car requirements, particularly in the low-octane ranges. The curve based on commercial samples available to motorists is therefore a realistic one.

The chart of 1957 models shows that roughly 92 per cent of all new cars successfully avoid trace knock with the current U. S. weighted average of 98.2 R.O.N. Roughly the same degree of satisfaction was plotted a year ago in comparing 1956 model requirements against the average premium octane at that time.

But this year there is a difference. The average determined for premium does not include the third grade superpremiums. These are not yet available throughout the nation. They can be purchased over a 39-state area which represents 85 per cent of the nation's demand for gasoline.

The conventional requirement curve shown here should be qualified in one other respect. The octane requirements of all of the 36 models were determined at sea level. In actual service over the country, this class of cars receives the advantage of a plus factor relating to altitude.

The average altitude effect on research-octane requirements amounts to about two octane numbers per 1,000 ft. at the 90-octane level, and one octane number per 1,000 ft. at the 97-octane level. Thus a car with a 97-octane requirement at sea level would be satisfied with a 96-octane fuel at 1,000 ft. above sea level.

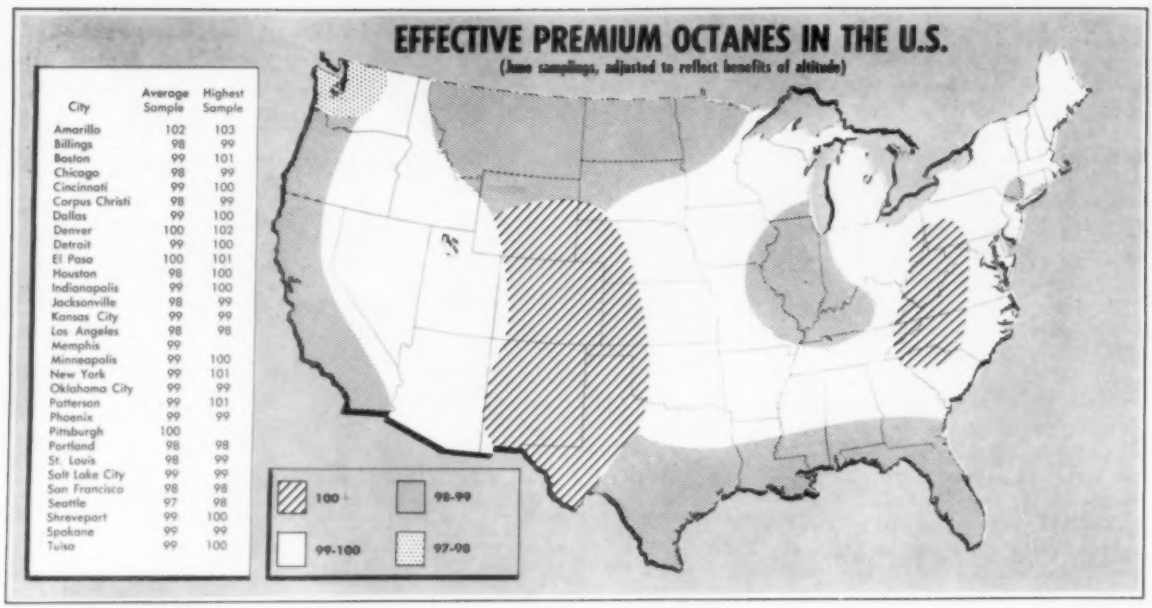
When this plus factor on altitude is taken into consideration, it becomes evident that much more than 92 per cent of all 1957 models are satisfied with locally marketed premium grades in much of the interior of this country.

Altitudes and octanes . . . Just how the factor of altitude affects the present picture on motor fuel, is illustrated in the map on p. 46.

The data are based on ratings reported in Ethyl Corp.'s June survey. In each of the 57 marketing centers, the arithmetical average of premium-grade samples was converted to the car requirements it would satisfy at the altitude of the city concerned.

Hence the map shows what might be construed as the "effective" octane ratings available in June from the standpoint of satisfying cars operated in the respective regions. What it actually shows is the car-requirement levels satisfied by average premium octanes throughout the country.

This map shows that cars of 100 R.O.N. needs (or more than 98 per cent of all 1957 models) are met by the average premium in the central Appalachians and throughout most of the eastern Rockies. With exception of the West Coast, the Montana-Dakotas region, the Central Mississippi Valley around Illinois, and a small area around Philadelphia, average premium is enough to meet the needs of 99-R.O.N. cars today. This repre-



City	Average Sample	Highest Sample
Amarillo	102	103
Billings	98	99
Boston	99	101
Chicago	98	99
Cincinnati	99	100
Corpus Christi	98	99
Dallas	99	100
Denver	100	102
Detroit	99	100
El Paso	100	101
Houston	98	100
Indianapolis	99	100
Jacksonville	98	99
Kansas City	99	99
Los Angeles	98	98
Memphis	99	
Minneapolis	99	100
New York	99	101
Oklahoma City	99	99
Patterson	99	101
Phoenix	99	99
Pittsburgh	100	
Portland	98	98
St. Louis	98	99
Salt Lake City	99	99
San Francisco	98	98
Seattle	97	98
Shreveport	99	100
Spokane	99	99
Tulsa	99	100

sents 95 per cent of all 1957 models for trace knock.

This plot shows significant improvement over 10 months ago (OGJ, Sept. 10, 1956, p. 79). Near the end of the 1956 motoring season, cars of 100-octane requirements were satisfied locally only in the West Texas-New Mexico area.

The altitude benefits aided average premium grades in meeting 99-octane car requirements through Colorado and part of Wyoming. The Upper Mississippi Valley and the West Coast in fact showed premium marketed then satisfied cars with only 96-97-octane needs.

But this map outlines effective octanes represented by the arithmetic average of all premium samples taken in each respective area. By shopping around, the driver of a high-requirement car can do better than the average.

It appears that with proper selection of best quality gasoline available the 1957 motorist can get the equivalent of 99-R.O.N. premium gasoline anywhere except along the West Coast. This indicates that well over 75 per cent of the motorists in this country have access to brands of premium gasoline which will prevent knock in cars needing 100 research-number fuel.

What about third grades? . . . Superimposed on this pattern of high motor-fuel quality is the third grade superpremium.

Introduced in the spring of 1956, this new marketing concept did not show widespread effect last summer. But this season, the full effect of the 100-plus third grade is evident over most of the country.

Third-grade brands are most highly concentrated in the competitive East Coast area. There, Esso Standard's Golden Esso Extra was followed this year by Cities Service's 100-Plus and Gulf's Gulf Crest. In the Deep South and through the Southwest, Standard of Kentucky and Humble, who introduced Golden Esso Extra last year, have been joined by Gulf Crest. Gulf has the Midwest and part of the Rockies to itself, at least for the time being.

In a few months, the East Coast and part of the Midwest will have another multigrade competitor. Later this year, Sun Oil Co. plans to extend its five-grade system now in effect in Florida. By spring of 1958 all Sun stations along the East Coast and as far west as Chicago and Louisville will be ready for the coming motoring season.

Meanwhile, Sun is marketing throughout its territory two grades which correspond roughly to regular and premium grades of competitors.

Third grade future . . . What pattern is forming on third grade?

For the present the picture seems stabilized. It is probable however that the third grade will eventually spread to the West. No indications of this are evident for the immediate future. The major companies seem to have made their stands on two or three grades for this season.

There is nothing to preclude a reversal, however, in the position taken by those who have stayed with two grades. In fact, some are still considering the possibility of adding another grade.

One way this might be done is to continue to distribute two grades to service stations. At the pump islands, an intermediate blend of the two grades could be marketed by tying pumps to both grades and mixing in some fixed ratio. This would entail some cost, but it is considered a feasible route by some companies. The pump need not be as complex as in Sun's five-grade systems.

Any plans involving this scheme or any others are closely guarded company secrets.

Stepped-up premiums hot . . . Meanwhile, the companies marketing a higher premium grade in the two-grade system are moving into the 100-octane range.

In June the Ethyl survey, which covers only the two grades, showed 10 samples sold by three companies in eight eastern cities. Surprisingly, of these 10 samples, 8 were better than 101 R.O.N.

The same June survey lists 36 samples of third-grade gasoline. These averaged 101.2 R.O.N. and 90.2 R.O.N. Of the 36 samples, mostly from the East, 10 rated between 100 and 101 R.O.N. and 26 were 101 R.O.N. or better, including one which tested 102 R.O.N.

This reflects some variables in pricing, based on octane alone. The third grades sell for up to 3 cents per gallon more than the premium in the same brands. But most of the stepped-up premiums in the two-grade systems are going for one additional cent over the previous premium marketed.

Some like it, some don't:

New Import Plan Readied

WASHINGTON. — There was an air of expectancy in the capital last week: President Eisenhower was expected to announce momentarily the Government's plan to control imports.

When it comes, it will provide for an across-the-board cut. The plan as "leaked" calls for major importers to cut back to a level 10 per cent below their average imports during 1954, 1955, and 1956.

This 10 per cent then would be distributed among newcomers in the importing picture.

It will be run on a "voluntary" basis—backed up by the gun of public opinion and the threat of government-enforced quotas if importers do not comply.

Industry and congressional reaction to advance reports of the plan ranges from ready acceptance to outright skepticism.

The administration will have 5 months in which to show that it can level the rising curve of imports. Congress is not likely to have time to do anything about it this year. But it will be back in January. And if the problem hasn't been solved by then the demand for formal quotas will be loud, insistent, and probably effective.

Here's how various segments reacted to the news:

. . . Most importers indicate they will go along willingly with the government program. While they view the issue as purely political and play down the national-defense aspect, they feel that enforced quotas are inescapable if this new effort at control fails.

. . . Marketers who see in imports a cramping force on product prices are said to be less happy. They oppose any control whatever on imports, fearing new price increases if foreign oil is barred.

. . . Domestic producers are disappointed. But for the most part they realize that it would be impossible to roll imports back to the 1954 level. Their major concern now will be whether the new plan will actually work.

The plan . . . The new controls, as "leaked" in Washington, will aim at keeping crude imports down to their 1956 share of the market. Officials say that would put them at around 1,000,000 bbl. daily.

Importers will be given individual guides to their "allowables." They will be asked to report whether they accept them. Both request and response will be published so that the public would know who isn't playing ball.

The 1957 rewrite of the program written in 1955 isn't going to meet with favor in all quarters, government officials admit. But they explain that the 1955 program, based on the 1954 ratio of imports to domestic output, is no longer adequate. So many refiners have started importing since then that a new deal is necessary.

While most importers are reported willing to go along with the plan, a few are expected to register protests. These will be companies with East Coast refineries built to process Middle East crudes.

Some companies, taking a long view, see foreign oil as an issue of less importance 2 or 3 years hence. They foresee that discoveries in this country will not keep pace with demand. This, they expect, will take the starch out of controls rather quickly.

Offshore Gas Field Opened

LAKE CHARLES, La.—Magnolia Petroleum Co. has opened the thirteenth field found this year in the Louisiana tidelands.

The discovery is in Block 64, East Cameron Area, and more than 20 miles offshore from Cameron Parish. The nearest field is 4½ miles away in Block 62.

Completion is in two gas zones. The upper sand, perforated at 9,804-16 ft., is rated good for 16,000,000 cu. ft. daily. The lower pay, at 10,294-10,306 ft., tested 9,000,000 cu. ft. per day. Total depth was 12,916 ft.

Trans-Canada Signs Contract

TRANS-CANADA PIPE LINES, LTD., has another customer for its 2,250-mile transmission system from Alberta to Montreal.

Lakeland Natural Gas Co., Ltd., signed a contract to take more than 12,000,000 cu. ft. of gas daily after 5 years. Lakeland has been certified to serve 17 communities from Port Hope to Morrisburg in eastern Ontario and is negotiating for other franchises between Port Hope and the Ontario-Quebec border.

The arrangement with Lakeland leaves only a few areas within the Trans-Canada system in which sales contracts have yet to be completed. Contracts have been signed with seven other firms. Delivery to Lakeland will start in 1958.

The new 20-year agreement calls for a gradual increase in deliveries. It requires 3,470,000 cu. ft. daily the first year, 7,219,000 the second, 9,007,000 the third, 11,390,000 the fourth, and 12,179,000 the fifth and thereafter.

Golf Links Leased

Hudson gets drilling rights on Los Angeles country club

LOS ANGELES.—Hudson Gas & Oil Corp., Shreveport, La., was high bidder for a lease on the 310-acre Los Angeles Country Club in West Los Angeles.

Four other companies submitted bids on the privately owned course adjoining the 20th Century Fox movie lot, where Universal Consolidated Oil Co. has been drilling with excellent results for several years. Universal Consolidated, however, did not bid on the country club property.

Hudson's bid called for a $150,000 cash bonus, 32 per cent royalty plus a percentage of net profits up to 62¾ per cent, depending on production.

Hudson is headed by J. K. Wadley, independent operator in Texas and California. Before any drilling can be done, a zoning variance must be obtained from the City of Los Angeles. When this is granted, Hudson will have 60 days to begin operations.

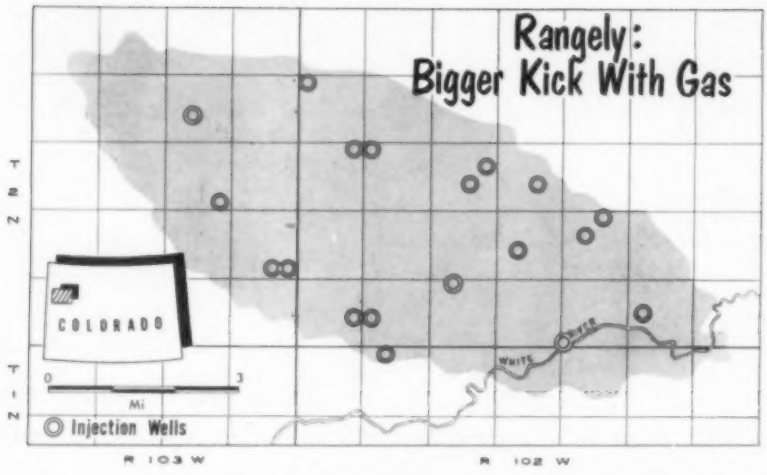
Meanwhile, Universal Consolidated expects to have its second rig on the movie lot drilling a 152-acre lease west of its present operations.

Montana Gets Amsden Strike

BILLINGS.—The Central Montana plains picked up another Amsden discovery last week.

The Musselshell County discovery well is Champlin Refining Co. and Republic Natural Gas Co. 2 Government. It is 1 mile west of Ivanhoe Dome field but is separated from production by dry holes.

The 2 Government flowed oil at the rate of 320 bbl. daily on 8/64-in. choke from the lower Amsden "B" sand at 4,130 ft. The Amsden, a basal Pennsylvanian, is the current prime target for Central Montana exploration. The new strike is the second of importance this year.



These 19 injection wells in Rangely soon will multiply:

Colorado Project Near

Commissioners may force action this week on unitization; operators set target date for secondary-recovery project

DENVER. — Efforts of state and oil-industry officials to unitize Rangely field may reach a climax in a series of meetings this week.

The Colorado Oil and Gas Conservation Commission will meet with Rangely operators committee Thursday. If the operators fail to submit an acceptable unitization program, the commission plans a more stringent order to prevent gas waste.

The operators plan a session Tuesday. At that time efforts will be pushed to complete a unitization agreement to hand the commission.

Operators previously had set a target date of September 1 to start the long-heralded secondary-recovery program in Colorado's largest field. The project envisions a pilot water flood and has gas reinjection on a unitized basis.

Details of the full program are being withheld by the Rangely Operators Committee. This group wants to button up the agreements on unitized operation of the 476-well field in Rio Blanco County before fully outlining plans.

This much is known about the Rangely program:

. . . Unitization is nearly complete. Agreement has been reached with 92 per cent of the operators and working interests, and 75 per cent of the 470 royalty owners have signed.

. . . Reinjection of gas produced with oil in the field is planned from the first. The 19 gas injection wells presently used in the field will be expanded into a more uniform pattern under unitization.

. . . A pilot water-flood project will be set up to test this recovery method for possible expansion later. Water reportedly will come from the White River, which runs through a corner of the northwestern Colorado field.

The operations . . . The California Co. will be the unit operator because it holds the largest interest. Calco also brought in the field's discovery well.

Other Rangely operators are Phillips Petroleum Co., Sharples Oil Co., Pan American Petroleum Corp., Continental Oil Co., The Texas Co., Union Pacific Railroad, and Cobb-Stringer-Superior.

Warwick Downing, chairman of the Colorado Oil and Gas Conservation Commission, says Phillips has not yet agreed to unitization because of a dispute involving an individual interest worked by the company.

Rangely unitization involves about 22,000 acres, of which 9,000 acres are public lands. Inclusion of the public lands makes the unit and operating agreements subject to approval by the U. S. Geological Survey.

Downing said the conservation branch of U.S.G.S. already has promised to approve the unit agreement without 100 per cent participation. But the state agency must first approve the proposals. When the unit begins operating, it will come under regulatory supervision of U.S.G.S.

Commission officials believe increased recovery at Rangely under unitization could exceed all other reserves in the state. That's the estimate of Art Jersin, commission director, and Bill Smith, commission engineer.

Rangely has produced 223,916,821 bbl. of oil and 210,555,552 M.c.f. of gas since Calco's discovery well, the A-1 Raven, was completed in 1932. Total oil remaining in the producing Weber sand is estimated at 1½ billion barrels. Primary methods are expected to recover 400,000,000 bbl. But this should be boosted to 700,000,000 bbl. by the secondary-recovery program.

Average daily production last month was 71,537 bbl. compared to 81,477 bbl. daily for the same period last year.

Flaring will end . . . Completion of Rangely unitization will climax a 10-year effort by the commission to end gas flaring in the field.

Operators currently are burning between 20,000 and 40,000 M.c.f. of gas daily.

The commission lacks statutory authority to require unitization or full gas reinjection, but it has hastened both by imposing controls to prevent waste. The agency issued an order July 17, 1956, limiting Rangely oil production to 300 bbl. daily from any one well and requiring reinjection of accompanying gas in excess of 180 M.c.f.

This action was taken after the Colorado Supreme Court in May 1955 held the commission was powerless to force reinjection of all gas. Since then, five operators have voluntarily continued the gas-injection program.

Downing estimated the commission order requiring reinjection of gas, issued late in 1951, saved 90,000,000 bbl. of recoverable oil before the directive was declared invalid by the court.

The commission chairman observes that the court decision "is the only one we can find on the books in the last 20 years that knocked out an order of the commission aimed directly at promoting conservation."

Other barriers . . . There have been many other blocks to unitization.

Operators agreed unitization would lower operating costs and increase production. But not all of them would accept gas injection as the only answer to the pressure-maintenace problem.

They pointed out that without a coordinated program, injected gas might channel and bypass oil in the reservoir. Also they argued a competitor's well might benefit from an

injected-gas flow which cannot be controlled underground.

But the major barrier to unitization was how to determine interests of each operator in Rangely and the value of these interests.

Factors included the potential of each well or group of wells, allowance for high gas-oil ratios, the economic limits of production for each well, and the benefits to be derived from secondary recovery.

Late comer . . . Although Rangely was discovered in 1932, development came only during the war years.

The field's isolated position and lack of pipeline outlets curtailed development until war-inspired demand opened markets to Rangely crude. Oil production at Rangely now is piped to Salt Lake City and through the Utah pipeline north to Wyoming and other markets.

Rangely currently is rated the 18th largest field in the nation in primary reserves, 34th largest in total reserves, and 57th largest in cumulative oil produced to date.

Contractors Plan Merger

HOUSTON.—Merger of Marine Drilling, Inc., and American Tidelands, Inc., has been approved by directors of the two companies. The proposal will be submitted to stockholders August 16.

Under the merger plan, the reorganized firm would retain the name, Marine Drilling, Inc.

Marine Drilling owns and operates four inland-water drilling barges along the Louisiana coast. President of the company is J. F. Corley, of Houston, who also is executive vice president of American Tidelands.

Control of American Tidelands was gained recently by a group including Lloyd M. Bentsen, Jr., Houston, who is new president of the company. The firm owns and operates one deep-water drilling barge now under contract to The Texas Co.

Wyoming Oil Law Sought

CHEYENNE, Wyo.—U. S. Sen. Joseph C. O'Mahoney is seeking a new oil law for Wyoming to help curb "continued importation of crude oil and oil products from abroad."

O'Mahoney has written Wyoming's Gov. Milward L. Simpson urging a special session of the legislature to enact the law, under which the state could control the purchase of crude. He pointed out that Kansas and Texas already have such laws. Gov. Simpson has declined comment on the proposal.

watching WASHINGTON

. . . with Bertram F. Linz

Barge boys are still battling . . .

MISSISSIPPI RIVER barge interests are trying to write another chapter in the long story of the Little Big Inch pipeline switch to products.

The barge people have been fighting Texas Eastern Transmission Corp. for some 3 years. So far it's been a losing battle, but they're still trying.

The Federal Power Commission okayed the switch from gas to oil back in 1955. The barge companies went into court and got their only decision so far. The court ordered the FPC to try the case again. It held the water haulers didn't get a fair chance to present their case.

The FPC again approved the transfer last month. The barge companies, which had complained in court that the FPC erred in skipping the usual examiner's report, filed for a stay of the new order. Their plea was rejected because they had not used other courses open to them.

The latest move of the barge companies is an appeal to the FPC for a rehearing. A 72-page brief charges the commission made 20 major errors in passing on the case. If FPC turns the water carriers down, they probably will go back to the court again.

Fire on agency oil advisers . . .

CONGRESS has been trying for several years to put curbs on some 1,700 advisory committees set up by the government departments. Most of them are serving the Defense Department. But the major targets have been the National Petroleum Council and the Military Petroleum Advisory Board of the Interior Department and the Big Business Advisory Council in Commerce.

The main charges against these groups are that they operate independently of government control, and businessmen members are able to advise the departments to their own advantages.

This month the House moved to lay down rules for the conduct of the advisory groups. It demanded that written notice be given Congress before any committee is set up, that all meetings have a government chairman, that full minutes be kept, and so on. But Rep. Clarence Brown, Ohio Republican, stymied the plan for a government chairman. He succeeded in changing the bill to read that a government official must either preside or be present at meetings. That would take the heat off the NPC and MPAB, which always have officials present.

The issue is purely political. The bill passed the Democratic House largely on a party division. It will not be taken up by the Senate this year. But if it ever reaches President Eisenhower he will veto it.

Navy backtracks on oil land . . .

DEFENSE and Interior officials have agreed on a plan to permit oil leasing on the Navy's big warning area on the outer Continental Shelf.

The military, charged in Congress with "land grabbing," hopes the agreement will help to head off a bill already passed by the House lodging control of land withdrawals at the Capitol instead of the Pentagon.

This is one of four oil problems the two departments are trying to iron out. The Navy is willing to give up the 20-odd million acres set aside for it in Alaska some years ago by Executive Order 82. Return of the land to the public domain, planned several years ago, may come soon.

The Army, on the other hand, is less willing to give up some of its land on Sand Island, Hawaii, where Standard Oil Co. of California would build a refinery. This will require an act of Congress not yet agreed upon.

The big fight, however, is over the oil shale plant at Rifle, Colo. Both Navy and Interior want it. Each claims it, and the attorney general may have to pass on the question. The plant will lie idle for at least another year. Then, whichever department wins title to it will come up with a new plan to put the Government back into shale research.

Just-completed Short Junction plant will provide the injection fluid as . . .

Conoco Readies First L.P.G. Flood

OKLAHOMA CITY.—Continental Oil Co. is counting on L.P.G. to boost ultimate recovery in Short Junction field 10 miles southwest of here.

Starting about August 1, Continental will pump 100,000 bbl. of propane and butane back into the Hunton lime in a 640-acre pilot section. This will be followed by natural gas.

If all goes well, operators at Short Junction hope to extend miscible-phase displacement to the rest of the 10,000-acre field.

The project means an early secondary-recovery start for a medium-size field with an interesting background. Since development began about 3 years ago, the pool has produced 4,700,000 bbl. of oil.

This is only a small part of the oil in place. As of January, reserves were estimated at 27,000,000 bbl.

The pilot project will be Continental's first field attempt at using L.P.G. in secondary recovery, although there has been some preliminary work in the lab. Here's why Short Junction was chosen:

. . . **Reservoir pressure** is still above the critical value. Continental, like more and more operators, wants to start secondary recovery while the pressure is still up.

. . . **A new natural-gasoline plant** has just been completed by Continental at Short Junction (OGJ, July 8, p. 83). This means an adequate supply of L.P.G. for the project. The plant, built by Tuloma Builders, Inc., Tulsa, can handle 60,000 M.c.f. of gas daily.

. . . **Gas-oil ratio is increasing,** and some wells are unable to make their 46-bbl.-daily allowable.

. . . **Continental wants to learn** more about miscible-phase displacement, the latest secondary-recovery method which is arousing the interest of oil men throughout the nation (OGJ, Mar. 11, p. 96).

Conoco's project . . . More than 30 operators have producing wells in Short Junction, but Continental owns about 40 per cent of the field. Anderson-Prichard Oil Corp., Sun Oil Co., Pan American Petroleum Corp., Ohio Oil Co., and Lone Star Producing Co. operate most of the remaining wells.

The pool has 200 wells producing 8,800 bbl. daily from the Hunton lime, found at about 8,000 ft.

Continental presented its plans at a recent meeting of operators in Oklahoma City, urging early unitization of the entire field—if the pilot is successful.

Only one injection well will be used at first. Depending on the success of the project, another injection well may be used later on the 640-acre pilot.

"One of the main factors in the success of this type program is the carrying out of the flood before the reservoir pressure drops below its critical value of 1,900 psi," Continental officials say.

However, they won't estimate on the amount of oil recoverable by primary methods, except to say that recovery "under present primary producing methods will be low."

Limestone strat trap . . . Short Junction, on the southwest flank of the Oklahoma City uplift in Cleveland County, has an interesting history.

Continental actually brought in the discovery well—the 1 Maruska—in June 1948, but there was no follow-up drilling. Continental was not sure that the zone would pay out.

The company waited until 1954 to acid-fracture the discovery. The response was good. This touched off a big drilling campaign. A mixture of gel acid and sand was used to bring in some of the earlier wells (OGJ, Dec. 12, 1955, p. 82).

The reservoir is a strat trap, pinching out against the overlying Pennsylvanian sediments. It is similar to West Edmond field 15 miles to the north. Both produce from the Bois d'Arc section, which is the upper part of the Hunton lime.

The big difference between the two fields is the size. West Edmond covers about 32,000 acres, compared to 10,000 at Short Junction.

In a state where sand accounts for about 95 per cent of total production, some operators questioned the value of lime production. Both West Edmond and its sister pool, Short Junction, have been watched very closely to see if they would pay off.

So far, both fields have been convincing arguments that Hunton lime production is profitable. West Edmond, for example, has produced more than 106,000,000 bbl. of oil since its discovery during World War II.

Now, with Short Junction stepping into a new phase of its comparatively young life, oil operators will be focusing their attention southwest of Oklahoma City to see how miscible-phase displacement will affect the payout.

Bisti Looks to L.P.G.

Sunray figures an early start in this young oil field may mean 60 to 70 per cent recovery of its 100,000,000 bbl.

FARMINGTON, N. M.—The nation's newest and most promising means of secondary recovery has spread to the Bisti area of northwestern New Mexico.

L.P.G. will be used to boost ultimate recovery in the comparatively new field, where oil in place is estimated at 100,000,000 bbl.

Sunray Mid-Continent Oil Co., operator of a proposed pilot project at Bisti, hopes that L.P.G. will result in a 60 or 70 per cent recovery of oil in place.

This is more than double an estimated 25 per cent recovery by primary means at Bisti. It is also much higher than could be expected from water flooding or ordinary gas drive.

Sunray's experiment at Bisti will be the first for New Mexico. Other L.P.G. projects have been launched in Texas, Oklahoma, and California, and more are in the planning stage (see page 50).

The Bisti project . . . Bisti is a young pool. It was discovered less than 2 years ago. By starting early in the life of the field—while bottom-hole pressure is still high—Sunray feels it will have a better chance at success.

Sunray's initial pilot project will take in only 160 acres. The plan calls for injection of 33,000 bbl. of L.P.G. into the Gallup sand. This will be followed by 500 M.c.f. of dry gas daily.

Only one input well will be used. It will be centrally located between four producing wells drilled on 40-acre spacing.

In its petition before the New Mexico Oil Conservation Commission, Sunray said "it is impractical at this time to state with exactness the duration of time that the L.P.G. program will be carried on or the duration of the dry-gas program."

Who's involved . . . The pool, which stretches about 15 miles in a northwest-southeast direction, contains about 100 wells. Sunray owns about one-fifth of them. Most of the Sunray wells are in the northwest portion near the pilot area.

British-American Oil Producing Co. and Phillips Petroleum Co. will be partners in the project. Supporting the experiment are Shell Oil Co., Amerada Petroleum Corp., and El Paso Natural Gas Co.

Sunray plans to obtain L.P.G. locally. It will be trucked in initially. Bisti field is just 12 miles southwest of the San Juan basin's big Blanco gas field.

One of the big stumbling blocks for Bisti production has been the lack of an outlet. Wells have been limited to 14 bbl. per day, which is sold to El Paso Natural for local refining.

But with the advent of new big crude lines to the Four Corners area, the crude will be able to flow southeast to Texas and southwest to Los Angeles.

Four-Corners Pipe Line Co. will complete its 16-in. Four-Corners-to-Los Angeles pipeline by the end of this year. And Texas-New Mexico Pipe Line Co. will start building its 16-in., 515-mile crude line from Utah to Jal, N. M., late this year.

Bisti's history . . . Production was discovered in Bisti in October 1955 when El Paso Natural completed its 1 Kelley State in San Juan County. Pay zone is the Gallup sand, a strat trap at 4,800 to 5,000 ft.

Significance of the discovery was not apparent until British-American brought in the 1 Marye in the spring of 1956 (OGJ, Sept. 17, 1956, p. 124). This kicked off a big drilling play, which is still going on in the southeast portion of the field.

The northwest portion is almost fully developed, except for the edges where the sand is very tight. Successful L.P.G. flooding could mean additional development in this tight-sand marginal area.

The sand is a basal member of the Mesaverde group of Upper Cretaceous age. Porosity ranges from 5 to 20 per cent, with permeability fluctuating drastically from 374 md. to zero.

Bisti is a solution-gas drive field. Most of the wells were completed flowing from 100 to 700 bbl. of oil daily, with an average gas-oil ratio of 550:1. No active water drive is indicated. Average completion cost is about $50,000 per well. Most wells require fracture treatment.

Sunray's role . . . Unlike some of the other integrated oil companies which are turning to miscible-phase displacement, Sunray is bypassing lab research.

Bisti will be Sunray's second miscible-phase program. In June the company began injecting L.P.G. into one of the producing zones at Newhall-Potrero field just north of Los Angeles (OGJ, July 8, p. 74).

The California project is a double-barreled program. Sunray hopes to store L.P.G. in the producing formation during slack summer months, and backflow it when demand is high. At the same time Sunray hopes the L.P.G. will increase ultimate recovery.

BISTI FIELD'S desolate terrain belies the more promising aspects of the underlying Gallup sand. Sunray Mid-Continent hopes to more than double ultimate recovery of oil by using L.P.G. It will be New Mexico's first miscible-phase displacement program.

Tanker Fleet Growing

Even American shipyards are caught in the world-wide construction boom; oil companies are the biggest owners

TANKER construction is on the rise throughout the world.

Even the United States, which has fallen behind other nations since the close of World War II, is building more tankers than it has in recent years.

Major oil companies still are the biggest owners of tankers in this country. They now control 494 ships, or 70 per cent of the privately owned tanker fleet in the United States. However, more than half the total carrying capacity is registered under foreign flag.

Figures on the world's tanker fleet and construction trends were compiled in a study made public recently by Sun Oil Co.

How U.S. Tanker Ownership Is Divided

Owner (including subsidiaries)—	No. ships	D.w. tons	T-2 equiv.
Oil companies:			
American Trading & Production Corp.	5	83,300	4.8
Atlantic Refining Co.	15	302,800	18.7
Barber Oil Co.	13	274,400	17.2
California-Texas Oil Co. (Standard of California and The Texas Co.)	57	906,000	53.6
Cities Service Oil Co.	17	419,900	27.9
Gulf Oil Corp.	53	1,071,000	66.0
Pure Oil Co.	8	126,400	7.6
Sinclair Refining Co.	14	245,000	15.5
Socony Mobil Oil Co., Inc.	36	744,200	47.5
Standard Oil Co. (Ind.)	11	179,500	10.4
Standard Oil Co. (N. J.)	139	2,363,600	141.4
Standard Oil Co. of California	25	442,800	27.3
Standard Vacuum Oil Co.	21	335,300	20.3
Sun Oil Co.	16	306,900	19.5
The Texas Co.	45	772,100	48.5
Tidewater Oil Co.	12	237,500	14.3
Other oil companies	7	115,400	7.1
Total oil companies	494	8,926,100	547.6
Nonoil companies	205	3,941,200	241.2
Total U. S. privately controlled fleet	699	12,867,300	788.8

Size of the gain . . . The Sun report shows that 879 tank ships totaling 25,488,000 deadweight tons were under construction at the start of 1957. This was a gain of 366 ships and 87 per cent in tonnage over the previous year.

Over a 2-year period the number of ships under construction more than doubled, and tonnage was up 175 per cent. Thus, not only the number of tankers but also the size of tankers is increasing. The average deadweight per ship under construction was 22,300 tons in 1954, compared with 26,600 tons in 1955 and 29,000 tons in 1956.

The rate of new construction far outstrips the rate of increase for the world's tanker fleet as a whole because many ships are retired from service each year. The Sun report states there were 2,778 ships of 44,882,600 deadweight tons at the year's start.

This topped the year before by 81 ships and 7.8 per cent in tonnage. The rise in 1955 over 1954 for the world fleet was 79 ships and 6.3 per cent in tonnage.

Compared with world total, tanker construction in the United States is small. But it is doing better. At the year's start, it had 45 tankers of 1,648,000 tons in its shipyards, compared with eight ships of 239,500 tons a year earlier.

During 1957, the Sun report says, there has been a substantial increase in the construction contracts placed with domestic shipyards. This will help to slow down the decline in the relative position of the United States fleet.

The biggest tanker construction nations in the world today are the United Kingdom and Japan. When the year began, the United Kingdom had 169 ships of 4,246,800 tons under construction, and Japan had 147 ships of 5,286,700 tons. Sweden was third with 129 ships of 3,391,800 tons.

Where oil stands . . . Within the U. S. oil industry, Standard Oil Co. of New Jersey is the big leader in tanker ownership.

Its carrying capacity is about one-fourth of the industry's total. Other leaders are California-Texas Oil Co. (Standard of California and The Texas Co.), Gulf Oil Corp., The Texas Co. and Socony Mobil Oil Co., Inc.

Two-thirds of Standard of New Jersey's carrying capacity was under foreign registry at the start of the year. All of the California-Texas ves-

sels were under foreign registry, while the carrying capacity of the other two was divided evenly between domestic and foreign.

While the oil companies held 494 tankers in the United States, other companies were controlling 205. About half the carrying capacity of the nonoil ships was registered under foreign flags.

The accompanying table shows the ownership of privately owned tankers in the United States (under both domestic and foreign flags), the number of ships, deadweight tons and T-2 equivalent. The T-2 equivalent represents a tanker of 16,765 deadweight tons capable of sailing at 14.5 knots.

Ratable-Take Hearing Set

BATON ROUGE.—State Conservation Commissioner John B. Hussey has set a hearing for July 23 to consider an application for mandatory ratable take of production from a Louisiana oil field.

The hearing was scheduled in response to a request by T. G. Markley, Baton Rouge independent operator. Markley is seeking an order prorating purchases on a per-well basis in University field of East Baton Rouge Parish.

Shale Ownership Disputed

DENVER.—Union Oil Co. is faced with two law suits, challenging its rights to nearly 9,000 acres of oil-shale land in western Colorado. Both cases are pending in federal District Court here.

The land is north of Grand Valley, where Union Oil recently began operating a new multimillion-dollar shale-oil processing plant (OGJ, May 20, p. 122).

One suit, filed by J. D. Freeman of Grand Junction, asks the court to confirm his title to 5,120 acres. This land was listed in an application field by Union Oil with the Bureau of Land Management.

Freeman claims Union is already "unlawfully" in possession of an additional 1,920 acres of his land.

The other suit was filed by 13 Virginians. The plaintiffs are asking the court for a judgment denying any claims by Union Oil to three sections of land totaling 1,920 acres in Garfield County.

The Virginians say that their ownership of mining claims dates back to October 1, 1919.

They claim that when Union published its notice of application for a U. S. patent last April 12, the lands were not open for exploration and were not a part of the public domain.

Processing briefs

British American Oil Co., Ltd., is on stream with a $4-million, 10,000-bbl. Catforming unit at its 21,000-bbl. Clarkson, Ont., refinery. The company is also installing the units, licensed by Atlantic Refining Co., at two other plants, a 4,000-bbl. unit at the 7,000-bbl. Edmonton refinery and another at Port Moody, near Vancouver.

Wilshire Oil Co. has added a 10,000-bbl. Platforming-Unifining unit at its 33,000-bbl. Norwalk, Calif., refinery. The unit was built by Southwestern Engineering Co. under license from Universal Oil Products Co.

Wilshire, which was a short step from liquidation 2 years ago (OGJ, April 22, p. 88), is also building up its marketing outlets. It will have 450 service stations operating under its brand by September, making it the largest independent refiner and marketer in California.

Contracts have been let for three units at the 20,000-bbl. Laurel, Mont., refinery of Farmers Union Central Exchange, Inc. The plant will get a 4,400-bbl. naphtha Unifining unit, a 7,100-bbl. middle distillate Unifining unit, and a 5,100-bbl. Platforming unit, all licensed by Universal Oil Products Co. Refinery Engineering Co. will start construction in August. Completion is scheduled for early 1958.

Surpass Petrochemicals, Ltd., of Scarborough, Ont., Canada, has placed in operation the first Canadian chemical processing plant to produce petroleum sulfonates. The $750,000 plant will produce 7,000,000 lb. per year of oil-soluble sodium sulfonates. It is equipped also to make other sulfonates containing lithium, calcium, barium, ammonium and amine. Petroleum sulfonates are used as additives to lube oils, corrosion inhibitors, insecticides, and dry-cleaning solutions. Girdler Co., division of National Cylinder Gas Co., designed and engineered the new Surpass plant.

Mississippi Chemical Corp.'s proposed 150-ton nitric-acid plant at Yazoo City will be designed and constructed by Chemical & Industrial Corp., Cincinnati, Ohio. This will be Mississippi Chemical's fifth nitric-acid unit of high-pressure design. Completion is scheduled early in 1958.

Hydrogen damage to steel refinery equipment is virtually eliminated by a process patented by Shell Development Co. Small amounts of air are injected into processing equipment where hydrogen might occur. Ammonia is added to maintain proper alkalinity. Shell is offering the process to oil companies through royalty-free license.

Delhi-Taylor Oil Corp.'s petrochemical plant at Corpus Christi, Tex., went on stream last week. The plant, which puts Delhi-Taylor formally into the chemical market, is a combination Platformer-Udex unit of Universal Oil Products Co. It was built by Refinery Engineering Co. to produce 45,000,000 gal. annually of high purity benzene, toluene, and xylene for the plastics, paint, pharmaceutical and other chemical process industries.

Enjay Co., chemical marketing affiliate of Standard Oil Co. (N. J.), is now marketing dicyclopentadiene, a chemical intermediate extracted from refinery streams. This petrochemical is used in making insecticides, printing inks, resins, and drying oils.

An additive to reduce rust in aviation gasoline and aircraft turbine fuel is being marketed by The Texas Co. Called Texaco Aircraft Fuel Inhibitor, the blending component is petroleum derived. Texaco says there are no metallic elements in the additive and that it does not react with metal surfaces. The company is blending it into its military aviation fuels, 15 to 20 lb. per 1,000 bbl.

Also for Refiners . . .

Octane ratings hold a margin over 1957-car requirements. This will allow Detroit designers to step up compression and horsepower in the 1958 models (p. 43) . . . The White House may get a new imports plan this week (p. 47) . . . Conoco has completed new natural-gasoline plant at Short Junction field which will provide fluid for an L.P.G. flood (p. 50) . . . Ohio Standard has rejected arbitration of its dispute with striking O.C.A.W. refinery workers (p. 61).

PLUS THESE TECHNICAL FEATURES: How Esso modernized dewaxing-plant controls (p. 82) . . . Refiner's Notebook (p. 111) . . . COST-imating (p. 113) . . . The Foreman's Page (p. 115) . . . and PETROdatics (p. 116).

Rig 44 picks up the kelly to spud 22,000-ft. hole.

New, Big Rig Starts Deep Test

FORT STOCKTON, Tex. — The most powerful rig in West Texas has spudded what may become the second deepest hole ever drilled.

The well is Phillips Petroleum Co.'s and Sinclair Oil & Gas Co.'s 1 "A" Montgomery, 12 miles south of here. It spudded on July 11. If it reaches projected total depth of 22,000 ft., it will be only 570 ft. short of the world-record Richardson & Bass 1 L.L.&E. in Plaquemines Parish, Louisiana. It will also displace Texas' old depth record of 19,060 ft. set by Magnolia Petroleum Co. in its 417-A West Ranch in Jackson County.

The rig is Great Western Drilling Co.'s new diesel-electric Rig 44. The prospective record well is its first.

Draw works motors are rated at 2,000 hp. for hoisting, making it most powerful yet rigged up for West Texas' hard-rock drilling. Each of the two main mud pumps has its own d.c. motor rated at 625 hp. In addition, there is an auxiliary pump fitted with two 300-hp. diesels.

Special turbo-supercharging makes the six diesels in the generating plant able to provide as much as 3,000 hp. for intermittent operation. The engines are installed two to a skid. They are "back to back" so that each pair drives a single d.c. generator.

There are also two small gas engines that drive 25-kw. a.c. generators for rig auxiliaries.

Great Western was able to rig up quickly, in spite of the size of the rig and the fact that this is its first well.

Moving commenced from the company's Odessa yards on Sunday morning and rigging up was virtually complete by Wednesday afternoon. Chief reason for the speed is the flexibility of equipment placement that goes with electric drive. Besides, Great Western had previously rigged up the rig in its yard and assembled the rig's crews there to get acquainted with it.

Gas Sale Approved

Southern Natural to tap 10 fields in Louisiana

WASHINGTON.—Another deal to bring offshore gas to inland markets has been approved by the Federal Power Commission.

The FPC granted Southern Natural Gas Co. a permit to build pipeline facilities costing $7,595,000 and connecting additional reserves in 10 Louisiana fields with its main system.

At the same time, the FPC issued certificates allowing Tidewater Oil Co., Gulf Oil Corp., Kerr-McGee Oil Industries, Inc., Phillips Petroleum Co., and Magnolia Petroleum Co. to sell the gas to Southern.

The 10 fields are located in Plaquemines, St. Bernard, and Jefferson parishes and adjoining offshore areas. They are estimated to have had 436.2 billion cubic feet of original gas in place, with an estimated total recovery of 386.7 billion cubic feet.

Southern will build some 60 miles of 6, 8, and 10-in. pipeline, 7,260 hp. in compressor capacity, and meter and regulating stations to link the new reserves to its system.

Gulf and Tidewater proposed an initial price of 19 cents per M.c.f. for their gas. The other companies proposed a rate of 21.25 cents.

The FPC order was opposed by Commissioner William R. Connole. Nine of the 10 contracts involve gas from offshore areas from which no production has been marketed, he said. He also charged that the contract prices are higher than any Southern now pays for purchased gas.

Connole pointed out that in the CATC case the FPC held that sales from offshore reserves should not be given permanent certification unless the rate level was shown to be in the public interest. Southern's reserves, although smaller in volume, are similar in importance and there is no basis for reaching contradictory conclusions "under such identical conditions," he said.

Airborne Refinery Operating

LODGE GRASS, Mont.—A portable refinery, small enough to be airborne, is being tested here by the Navy Department.

The small, compact unit is designed to support advance base operations where the supply of petroleum is scarce or difficult to ship.

Capacity of the unit is 1,000 bbl. daily. It can turn out motor-grade gasoline, kerosine, diesel fuel, and re-

sidual, which can be further processed into asphalt.

The refinery is being developed by the U. S. Bureau of Yards and Docks, a branch of the Navy. Navy personnel from Port Hueneme, Calif., are handling the field tests.

Test Breaks Record

Magnolia heads for 20,000 ft. in Oklahoma wildcat

ANADARKO, Okla.—Oklahoma's deepest well is approaching the 3½-mile mark and has struck a sandy shale section that geologists don't recognize.

Magnolia Petroleum Co.'s geologists hope that soon their record-breaking 1 Sterba-Ordovician in Caddo County will penetrate formations they're familiar with and will eventually find a pay zone in the Simpson.

When drilling hit 18,369 ft. last week 111 ft. below the previous record of 18,158 ft.—division geologist Eric Bucher remarked, "We're not entirely sure what we're in. It's a long shale and sandy shale section, probably Mississippian age. But there's nothing to identify it."

"It's in a section of the Anadarko basin never penetrated before."

The well is scheduled to go to 20,000 ft., but, if necessary, Bucher is willing to go beyond that—even below the world's record drilling depth of 22,570 ft.

"I don't think we need to," Bucher said. "But that's all speculation. We anticipate not having to go that deep—but you never know."

A spokesman for Magnolia in Dallas said condition of the hole is good—"as good as we ever drilled."

The well is on the south flank of the Cement field structure in SW NE SW of Section 36-6n-10w.

Magnolia is committed to 20,000 ft., but to go beyond that the company would have to consult its partners.

The old Oklahoma drilling record was an 18,158-ft. dry hole, Frankfort 1 Pruitt, drilled last year in Grady County. The deepest producer in the state is British-American Oil Producing Co.'s 1 Reed, which came in early this year at 15,575-15,645 ft. in the third Bromide-Ordovician sand of the Knox field in Grady County.

The Magnolia well originally sought to tap the Arbuckle at 15,000 ft., but it's prime objective now is the Simpson section, including the Bromide sands. British-American found prolific Simpson production on the Carter-Knox structure in Grady County to the east.

Industry briefs

North Louisiana has a new producing-depth record at Red Rock in Webster Parish. A Carter Oil Co. field well, the 1 Sanders-Farmers Bank Unit, found production in the Smackover "C" zone at 10,958-11,011 ft. The old record was in the same field at 10,915-11,000 ft.

Red Rock was opened more than 2 years ago. Daily production from 23 Smackover wells is 2,361 bbl. The field has been combined with East Red Rock and is linked with shallow production in North Shongaloo field (Pettet).

The proposed pressure-maintenance program for Pembina field will be heard before the Alberta Oil and Gas Conservation Board July 23. Harry Bass & Sons, Inc., has asked for authority to build a natural-gasoline plant at Pembina, one of the largest fields on the continent.

Thirty-three other companies will be represented at the hearing. The Bass proposal was selected by the Pembina operators' committee as the best of several plans to conserve natural gas and develop pressure maintenance in the field (OGJ, June 3, p. 80).

Canadian Husky Oils, Ltd., has started geological work to evaluate a 4,700,000-acre area in the Yukon and Northwest Territories. The firm recently obtained exploration permits for the area from the Canadian Government.

The northernmost of five blocks held by the company is within the Arctic Circle about 75 miles southwest of Aklavig. A helicopter, airplanes, and canoes will be used by geological teams working on the project. Two teams are now working in the Porcupine Block Plateau area.

Bids for 22,400 acres of Navajo and Ute Indian lands will be opened at a lease sale in Gallup, N. M., August 8. The Indian lands are in San Juan County, northwestern New Mexico, in the Four Corners area. Successful bidders will be required to hire Indian labor in drilling operations.

Arkansas has a new depth record in Hunt Oil Co.'s 1 McDonald, 5 miles southwest of Emerson in southern Columbia County. The wildcat was in the Buckner formation at 12,705 ft. last week and will reportedly drill to the Smackover lime or deeper.

The previous deep hole was Shell Oil Co.'s 1 Browning-Burns Unit in Springhill field 12 miles east of the Hunt test. Drilled in 1952, the Shell well went to the Buckner at 12,650 ft. It was dry at that level but was later completed as an oil producer in the Tokio.

Magnolia Petroleum Co. has lowered its postings for Mirando-type crude 20 cents a barrel. The cut is Magnolia's second in 3 months, but the price is still 35 cents a barrel higher than it was in June 1953 when the crude was going for $2.86.

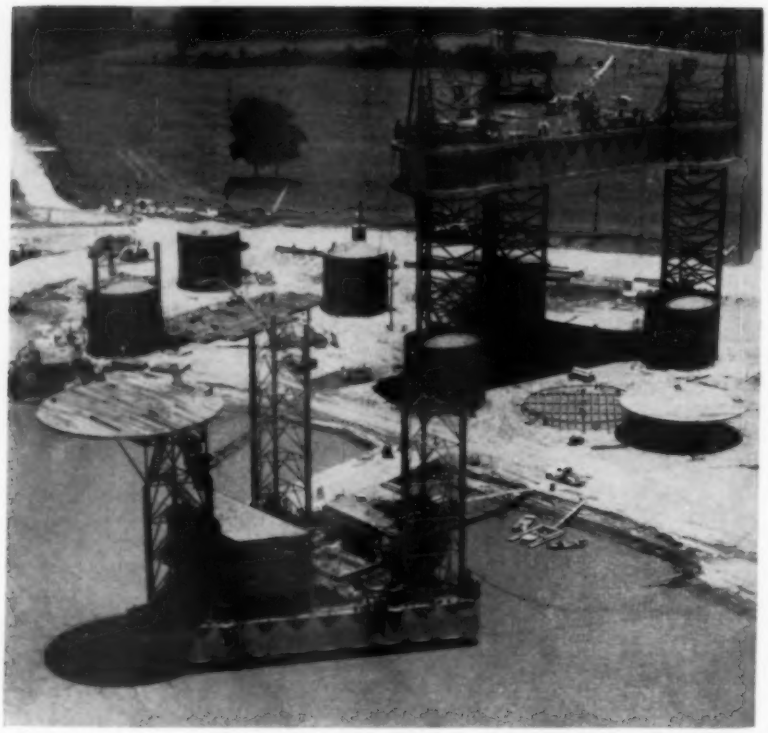
Magnolia's first increase was 15 cents a barrel in June 1956. In January of this year the company posted a 35-cent increase, bringing the price to $3.46, but it reversed the trend last April with a 5-cent cut. The latest decrease brings the company's price to $3.21. Quotations are for below 24°-gravity crude.

Nebraska may rewrite its drilling and production regulations. The conservation and survey division of the state geologist's office has scheduled a hearing August 7 in Sidney on proposed changes covering both oil and gas. Here's how extensive the proposals are: If they go through, the number of pages in the rule book will be increased from 2 to 12.

The Montana Land Board will hold its next auction of state oil and gas leases in Helena August 21. This will be the state's first auction under a revised land board policy of fixed sale dates. Previously, such auctions had been scheduled by the board at irregular intervals after sufficient applications were received from prospective leasors.

Tidewater Oil Co.'s new Delaware City, Del., refinery has worked out an agreement to train eight volunteer fire companies in their area in fighting oil fires. The local fire companies will be better prepared to handle oil fires in their communities and Tidewater will be able to supplement its fire fighting force in case of emergency.

Three more tankers have been ordered bringing the total now on order in U. S. shipyards to 86. According to the Shipbuilders Council, half the total on order are of 40,000 deadweight tons or more.



VERSATILE platform is dwarfed by its sister tripod at Vicksburg shipyard before sailing down the Mississippi for christening at New Orleans. A wide variety of offshore work awaits the "Deepwater 11" as...

Pint-Size Tripod Goes to Sea

NEW ORLEANS.—A versatile new three-legged drilling platform, designed for offshore wildcatting, workover, and completion operations, was christened here last week.

The unit was built for Deepwater Exploration Co., Houston, at the R. G. LeTourneau, Inc., shipyards at Vicksburg, Miss. It's scheduled to go to work immediately for Gulf Refining Co. in Bay Marchand Block 21 off Louisiana.

Known as a "vest-pocket" platform, the Deepwater 11 is a miniature model of the larger LeTourneau-built tripods put into service earlier (OGJ, Mar. 18, p. 97).

The new unit is 121 ft. long and 118 ft. wide. It's designed to drill to 10,000-ft. depths in water as deep as 70 ft. Price tag for the Deepwater 11 is $1,850,000.

The deck of the new unit can be raised or lowered at the rate of a foot per minute.

The derrick, draw works, and substructure can be skidded as a unit onto a fixed platform for workover operations, then returned to the mobile unit.

Lateral shifting of the drilling machinery will permit the drilling of two wells from one location and will ease the problem of servicing multiple wells.

After its assignment for Gulf Refining, the new platform will drill for Humble Oil & Refining Co., Anderson-Prichard Oil Corp., and Climax Molybdenum Co.

Humble Picks Plant Site

HOUSTON.—The world's largest cycling plant will be built by Humble Oil & Refining Co. in Kleberg County, Texas, adjacent to Humble's Seeligson compressor plant. The site is about 15 miles southwest of Kingsville, Tex.

Humble announced earlier the installation—King Ranch gas plant—will have a daily capacity of about 750,000,000 cu. ft. of gas and will recover some 25,000 bbl. of liquid products per day (OGJ, June 10, p. 63).

Construction is expected to start in mid-summer 1958, although work on pipeline and gathering systems probably will start earlier in the year. Cost of the plant, gathering lines and transmission line to the Houston area has been estimated at $75 million.

The plant will open many shut-in wells on the vast ranch.

Salt Dome Extended

Production found at one of farthest points from shore

MORGAN CITY, La.—A wildcat drilled by Phillips Petroleum Co. more than 40 miles off the coast of St. Mary Parish, Louisiana, last week extended production on recently discovered Eugene Island Block 188 salt dome more than 3½ miles from the north to the far southwest flank.

The well, one of the farthest from shore to find production in the Gulf of Mexico, indicates one of the largest offshore domes so far found.

The well is 2-A OCS-0473 on Phillips' "Shark" lease. It is productive from 40 ft. of casing perforations opposite a 61-ft. Miocene pay zone at 8,663-8,724 ft. With production restricted to a small choke, it flowed at the rate of 672 bbl. of clean oil per day.

This is the second hole drilled by Phillips from the same offshore platform. The first (1-A) was abandoned at 6,450 ft.

The strike is on a full-interest, 5,000-acre federal lease comprising Block 191, Eugene Island area. This block adjoins on the south Block 188, on which Shell Oil Co. and Humble Oil & Refining Co. are carrying on a joint development program around the north flank of the dome.

New Oil State?

Good flow reported in wildcat in Washington

SEATTLE.—A good show of high-gravity oil was found last week in Washington's Grays Harbor County.

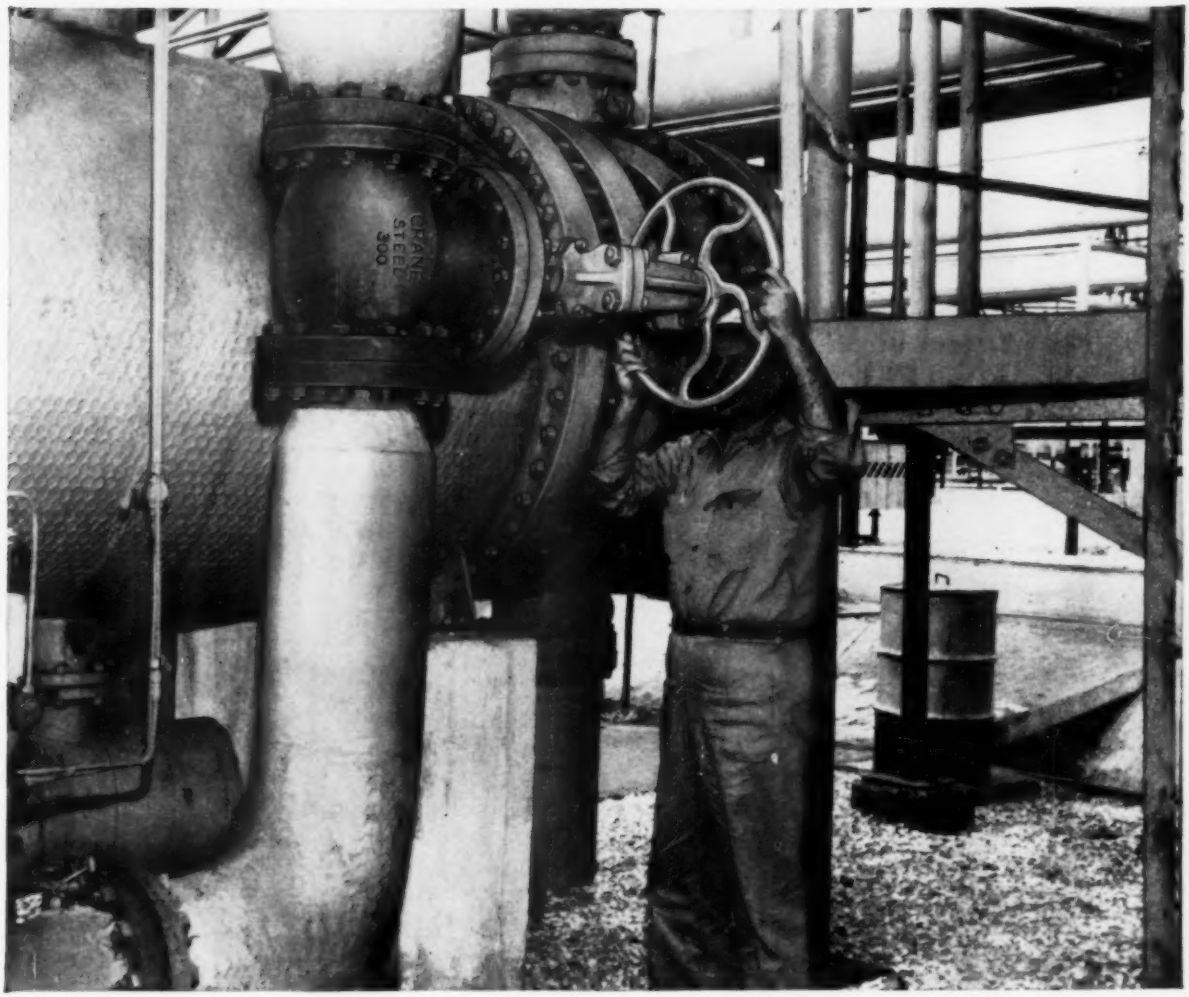
If the test should prove successful, it would be the first commercial production for the state.

The wildcat is the 1 Madina of Sunshine Mining Co. and J. W. Tanner. Fred Wurden, Sunshine geologist on the well, said the test flowed at a rate of 400 bbl. of 48°-gravity oil on a drill-stem test. Production was from the Nye (Lower Miocene) at 3,940-63 ft.

The wildcat is in the previously explored Ocean City area. Encouraging flows have been encountered in the area before, but in all previous cases production dropped off to noncommercial rates after a matter of hours.

Union Oil Co. was the first to find oil in the state. It had good shows in Miocene sands in 1950. The following year the Hawksworth et al No. 4 State flowed at rates ranging from 35 to 100 bbl. daily but later was abandoned.

How Cit-Con stopped valve leakage in lube oil extraction



These Crane valves defy hot oil at 550° F.

You'll recognize smart planning in this valve installation at the Lake Charles, Louisiana, extraction tower of Cit-Con Oil Corporation, manufacturer of lubricants and waxes.

Before Cit-Con installed these Crane 8-inch No. 47X steel gate valves on lines to regulator, valves of another make were demanding frequent maintenance to cope with leakage of hot oil at 550° F.

The change to Crane completely corrected the problem. Why? Because Crane steel valves with Exelloy seating have those extra features that count in valve performance—better design throughout, finer workmanship and more thorough testing.

When you buy valves, you're wise to insist upon the engineering skill and quality manufacture you get when you order from Crane.

ASK TODAY for this book with 32 industrial case histories. Call your Crane Man for a copy of "Valve Performance Facts."

CRANE VALVES & FITTINGS

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Since 1855—Crane Co., General Offices: Chicago 5, Ill. Branches and Wholesalers Serving All Areas

How to Beat the Heat—at 2,000° F.

AN ALUMINIZED suit with a built-in air supply is ready to let firefighters walk into the hottest flames.

Wayne Campbell of Guardian Safety Equipment Co., Tulsa, is shown in the middle of a gasoline fire closing a mock valve in heat which went to 2,090° F. during a demonstration at Phillips Petroleum Co.'s Kansas City refinery.

In another fire, created by propane jets, Maxwell worked in temperatures up to 2,170° F. after skirting the flames to demonstrate protection from radiant heat. In both fires, the suit was exposed to the intense heat for about 30 seconds—long enough to close a valve or rescue a man.

The suit is manufactured by Fyrepel Products, Inc., Newark. The material is primarily glass fiber, but the key is a microthin coating of aluminum which reflects 95 per cent of radiant heat. The thin film, thinner than foil, results in lightweight and flexibility. The finish was developed by Minnesota Mining & Manufacturing Co.

Second Pool Indicated at Palo Duro

AMARILLO. — The Palo Duro basin in the Texas Panhandle, the nation's newest oil-producing province, may have a second producer.

The prospect is Shell Oil Co. 1 L-S Ranch in Oldham County. The well is 12 miles northeast of Alamosa Ranch field, the basin opener. It surfaced gas in 10 minutes on a 1-hour drill-stem test of the Missouri-Pennsylvanian at 8,254-78 ft. Flow was at the rate of 280 M.c.f. per day.

The recovery included 45 ft. of 49°-gravity oil, 45 ft. of heavily oil and gas-cut mud, 90 ft. of slightly oil and gas-cut mud, and 90 ft. of gas-cut mud. Drilling is continuing below 8,484 ft.

Shell's well is 3¾ miles southeast of Magenta, Tex. Shell is drilling two other important wells in this sparsely tested and extensive basin. They are the 2 Alamosa Ranch "A," 13 miles northwest of Vega and ⅝-mile southwest of the field discovery well, and the 1 Alamosa Ranch "B," 6 miles southeast of the discovery.

Alamosa Ranch field was opened last spring. The discovery well flowed at more than 400 bbl. daily.

Denver Basin Is Extended

DENVER.—A new discovery well extending Denver basin production 12 miiles north in western Nebraska has been completed. The 1 State-A pumped 109 bbl. of oil daily from the Dakota "J" sand.

Tom Vessels, Jr., and Strain Drilling Co., drilled the well in Scotts Bluff County. It is 6 miles southwest of Gering, Neb., and is the northernmost production in the Nebraska portion of the Denver basin.

Contractors note:

Two More Reasons For Drilling a Hole

BAKERSFIELD. — The drilling slump is resulting in some unusual jobs for California contractors.

Barnes Core Drilling Co. of Bakersfield recently signed up to drill 30 steam wells in a geyser area north of Santa Rosa for Thermal Power Co. of San Francisco. The 600 to 1,500 ft. wells will tap steam for use in electric generation.

And now Hagestad Drilling Co., also of Bakersfield, announced last week it will drill a 3,500 ft. test in Nevada for the Atomic Energy Commission.

Purpose of this job is to see what effect the A-bomb tests have had on subsurface strata and fresh water. Hagestad is sending an Emsco 350 for the well.

U.O.P. Sale Nearer

Only legal formalities remain after agreement

NEW YORK.—Sale of Universal Oil Products Co. will be completed soon.

Only legal formalities still remain. They are expected to be removed soon. Then a public offering of U.O.P. stock will be made in line with terms of agreements revealed here last week.

The agreement provides that sale of U.O.P. will not:

... Give dominant control of the firm to any one company.

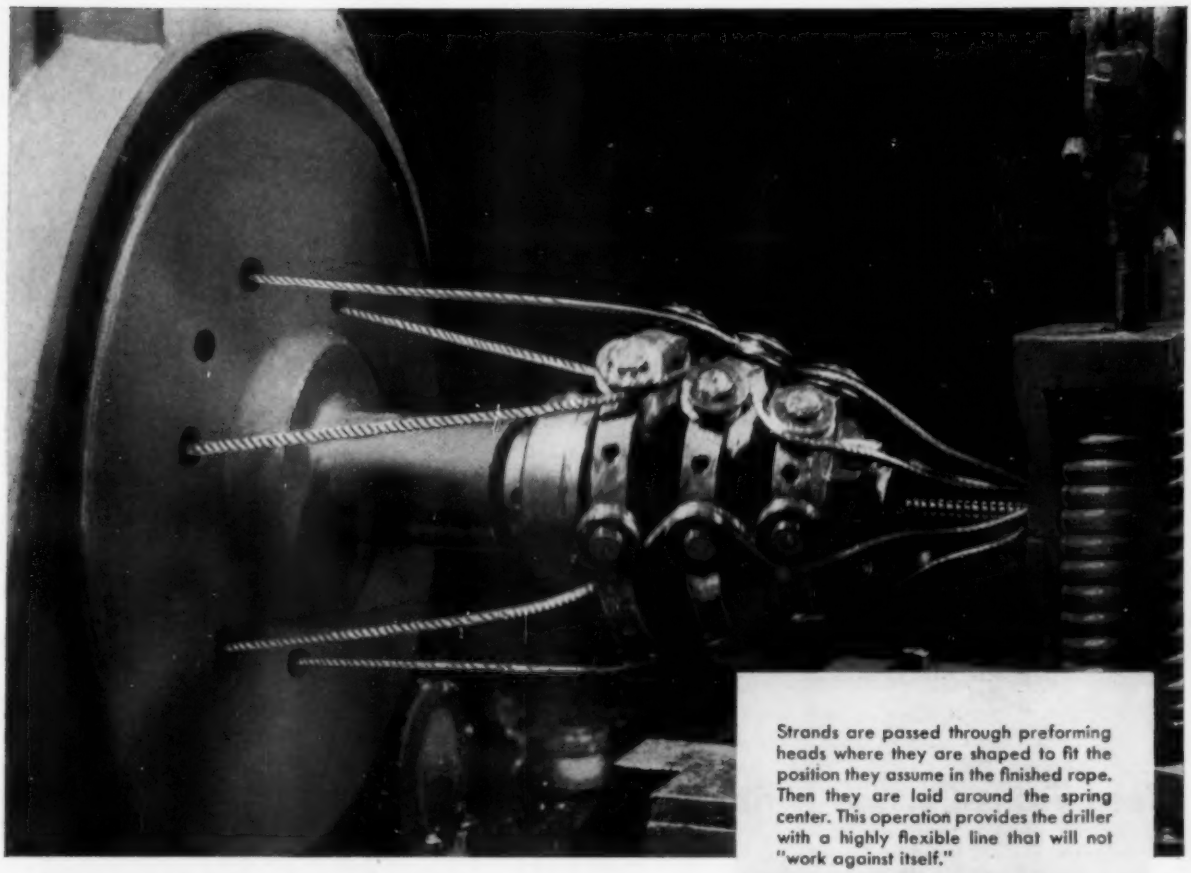
... Interrupt U.O.P. services now available to refiners.

These terms first were revealed earlier this year (OGJ, Mar. 25, p. 102) and confirmed last week in a public hearing before Louis M. Loeb, referee.

The hearing before Loeb was attended by all interested parties, and it was apparent they agreed on limiting individual purchases to 2 per cent of the total stock and guaranteeing continuance of U.O.P. services to refiners.

Represented at the hearing were Guarantee Trust Co., trustee for the Petroleum Research Fund; the American Chemical Society, the fund's beneficiary; independent refiners; and the New York attorney general.

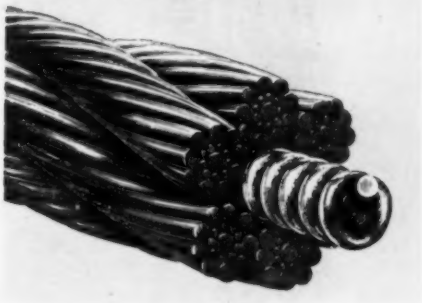
Loeb will pass his findings to New York Supreme Court Justice Jacob Markowitz. In view of the accord among litigants, approval by Markowitz is regarded as a foregone conclusion.



Strands are passed through preforming heads where they are shaped to fit the position they assume in the finished rope. Then they are laid around the spring center. This operation provides the driller with a highly flexible line that will not "work against itself."

SPRINGKORE

the wire rope designed for ROTARY DRILLING



SpringKore wire rope is specially designed to stand up under the line stresses of heavy-duty rotary rig drilling. The steel spring center enables SpringKore to "snap back" after the crushing action at the drum and to resist the severe wear at the crown and block sheave. Field tests prove that SpringKore retains flexibility and resistance to crushing longer than any other drilling line now in use.

The hollow inside center of the spring acts as a lubricant reservoir that provides complete lubrication of the rope's innermost parts for the entire service life. Its coiled spring shape gives the outer steel strands of the wire rope firm supporting points which reduce internal pressures and friction.

SpringKore rotary lines are immediately available in standard sizes. See your regular J&L supplier or send the coupon for complete information.

Jones & Laughlin
STEEL
... a great name in steel

Jones & Laughlin Steel Corporation
Wire Rope Division
Muncy, Pennsylvania

☐ Please send information on SpringKore.
☐ Have representative call.

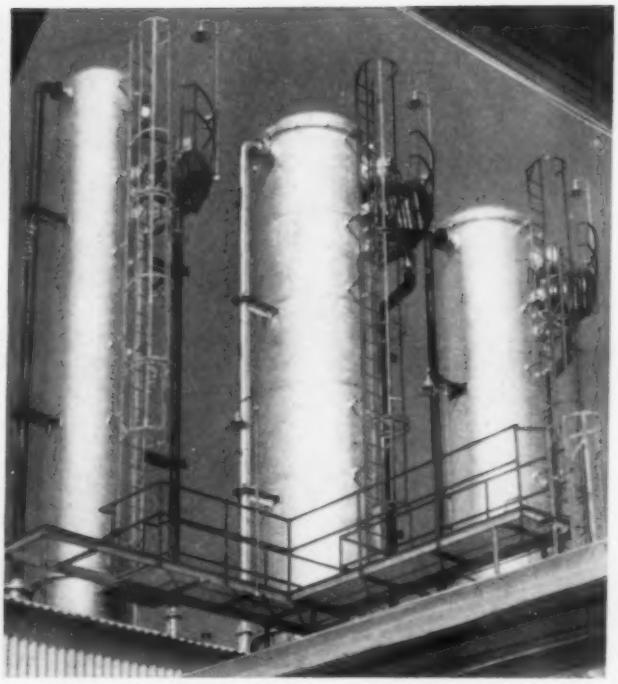
Name_____

Title_____

Company_____

City_____ Zone____ State_____

WORLD'S BIGGEST source of sour-gas sulfur is title due B.A.'s Alberta plant. It's now producing 225 tons daily.



IMPORTANT SOURCE of L.P.G. and condensate will be this absorption-fractionation unit, which strips rich Pincher Creek gas.

When Trans-Canada is finished . . .

Pincher Creek Will Be the Biggest

PINCHER CREEK, Canada's largest gas-condensate reserve, is coming to life.

As time passes during the next 4 years, it will become more and more important—and in several ways.

It will, for example, become the largest source of gas for the now-building Trans-Canada pipeline.

As this market opens and the flow increases, British American Oil Co. will put its new extraction-cycling plant into high gear. And when this happens, the field will become the world's greatest source of sulfur from sour natural gas. Its sulfur capacity will more than double that of the Worland, Wyo., plant of Texas Gulf Sulfur Co., now the world's largest.

It also will rank then among the largest producers of L.P.G., natural gasoline, and condensate. Even the condensate will be of special importance. It is considered a "prime quality crude" and excellent as a feed stock for catalytic reformers.

What's happening now . . . British American hasn't waited for Trans-Canada to complete its pipeline. Last January an extraction-cycling program began operation. The project was initiated by Canadian Gulf Oil Co. before it was absorbed last year by B.A.

The plant now processes sour wet gas from two wells, extracts liquids and sulfur, and returns the dry, sweet gas to the reservoir through a single injection well.

This cycling program will continue until deliveries to Trans-Canada start late this year. The present plant, called Stage 1, is about one-fourth the size it will be when production is at full blast.

The plant now processes 60,000,000 cu. ft. of gas daily. From this it extracts 1,800 bbl. of condensate and 225 long tons of sulfur.

Stearns-Roger Engineering Co. built the conventional extraction plant, and Ralph M. Parsons Co. built the adjacent sulfur-extraction unit. The sulfur unit separates the hydrogen sulfide from the dry gas and converts it to elemental sulfur, which is shipped in both liquid and solid form.

Following stabilization, the condensate-natural gasoline fraction is shipped to refineries in western Canada for processing or direct blending to motor fuel.

What's ahead . . . B.A.'s contract with Trans-Canada calls for 100,000,000 cu. ft. of gas daily for the first year of pipeline operation and 170,000,000 after that.

During this period, daily output of the extraction plants will be stepped up to 2,500 bbl. of condensate and natural gasoline, 17,000 gal. each of propane and butane, and 275 long tons of sulfur.

By 1961, when Stage 2 is in operation, B.A. estimates production will be 6,500 bbl. of condensate and natural gasoline, 43,000 gal. each of propane and butane, and 700 long tons of sulfur.

The Pincher Creek condensate is considered excellent catalytic reforming stock, and its production at Pincher Creek will be an important contribution to the manufacture of high octane gasoline in western Canada.

If B.A. plans to process this condensate in its nearest refinery at Calgary, the refinery's capacity must be expanded. Calgary is now rated at 7,200 bbl. per day capacity, and its 2,000-bbl. Catforming unit would have to be expanded about fourfold to handle the new charge stock.

Arbitration Vetoed

● Union offer rejected by strike-bound Sohio; plants idle since June 7

CLEVELAND.—Standard Oil Co. (Ohio) has rejected arbitration of its dispute with the striking Oil, Chemical, and Atomic Workers International Union.

O.C.A.W. suggested the issues be outlined to an outside umpire whose decisions would be binding on both parties. The company refused, saying the main issue is not wages but company-wide bargaining.

Two Sohio plants in Cleveland, and one each in Toledo, Lima, and Covington, Ky., have been shut down by strikes since June 7. Combined capacity is 140,000 bbl. daily.

Clyde T. Foster, president of the company, said that since the strikes involve separate and scattered bargaining units, "settlement can be attained only by negotiations of the issues involved at each of those locations."

Foster pointed out that there is no disagreement on the 1957 wage increase. Both sides have proposed 6 per cent, an increase accepted by most other local O.C.A.W. units and other oil companies. (OGJ, May 20, p. 124).

Earlier this month, Sohio filed an $856,000 damage suit in federal District Court against O.C.A.W., charging that the union engaged in secondary picketing on a construction project at the Toledo refinery (OGJ, July 15, p. 69).

In offering to arbitrate, O.C.A.W. requested that all pending legal actions be withdrawn by both sides.

Gulf Coast strike . . . At Pasadena, Tex., Crown Central Petroleum Corp.'s 35,000-bbl. refinery was still shut down after more than 10 weeks of O.C.A.W. strike action.

The local O.C.A.W. bargaining unit was the target of a blistering attack by R. T. Colquette, vice president of Crown Central. He said the company is being asked to pay increased labor costs "three times the amount other refineries have agreed to pay" in the Gulf Coast area.

If allowed to set an industry pattern, he said, union demands could cost the oil industry $26,000,000 a year.

He singled out union demands for "extra staffing," estimating that these alone would cost Crown Central another $100,000 annually.

Pipeline briefs

Service Pipe Line Co. has awarded a contract to Midwestern Constructors, Inc., Tulsa, to build a 165-mile, 10-in. crude line from Griffith, Ind., to Muskegon, Mich. The project is Muskegon Pipe Line Corp.'s 26,000-bbl. daily line from the Service system at Griffith to serve Aurora Gasline Co. and Naph-Sol Refining Co. refineries.

Service and Aurora are joint owners of Muskegon Pipe Line, to be completed late this year. Service will build and operate the line as agent for Muskegon. The line will be operated initially with only the originating pump station at Griffith. Later, as throughput demand increases, a second station will be built. The line will move three types of crude oil without intermingling.

Tecumseh Pipe Line Co. has awarded a contract to Morrison Construction Co. for 15 miles on the western end of its 200-mile, 20-in. crude line. O. R. Burden Construction Corp. has been working since late spring on the remainder of the line, running from Griffith, Ind., to Cygnet, Ohio.

Tecumseh, owned by Sinclair Pipe Line Co., Ashland Oil & Refining Co., and Pure Oil Co., will transport 100,000 bbl. daily with one station at Hartsdale, Ind. Ultimate capacity, with another station, will be 170,000 bbl. daily. It will serve refineries in Ohio, Michigan, and New York. Completion is set for September.

Changes in tariffs by Westspur Pipe Line Co. and Trans Prairie Pipelines, Ltd., have resulted in slight adjustments of Saskatchewan and Manitoba crude postings by Imperial Oil, Ltd. Prices to producers were raised by a half to 3 cents per barrel, except in one case where a 2-cent cut was posted.

Trans Mountain Oil Pipe Line Co. is suffering from the sharp drop in tanker rates. Crude deliveries for June dropped to 139,528 bbl. daily, a low for the year, compared with 200,000 bbl. daily in April and May.

Cheaper tanker rates make it attractive for California refiners to turn to Sumatra and other sources rather than Canada to help supply their crude deficit. Trans Mountain expects an upturn in demand, however. Delivery estimates are 158,000 bbl. daily for this month and 165,000 bbl. daily for August.

Texas Eastern Transmission Corp. and its affiliate, Wilcox Trend Gathing System, Inc., plan additional expansion costing about $4,000,000 this year. The general application, filed with FPC, seeks to cover facilities necessary to purchase new gas supplies from independent producers along the companies' existing lines. This type of application, with exact facilities to be approved later, is designed to expedite handling of minor projects before FPC.

Ohio Fuel Gas Co. has received FPC approval to build and operate $4,702,900 in natural-gas pipeline facilities. The order includes 38 miles of 24-in. loop from Ohio Fuel's Crawford compressor station in Fairfield County, Ohio, to Treat station in Licking County. A 17-mile, 20-in. line will be built from Jackson County to the Symmes station in Lawrence County. The 38-mile line will increase capacity 74,000,000 cu. ft. daily and the 17-mile line 39,000,000 cu. ft. daily.

Fulton Banister, Ltd., has started construction on a 22-mile, 3 to 12-in. gas-gathering system for Provo Gas Producers, Ltd., in Provost field, Alta. Provost gas will be fed through Alberta Gas Trunk Line Co., Ltd., which Fulton Banister also is building, to Trans-Canada Pipe Lines, Ltd.

Also for Pipeliners . . .

Southern Natural has FPC approval for a plan to tap 10 gas fields in Louisiana both onshore and offshore (p. 54) . . . Pacific Gas & Electric's new gas line from western Canada to northern California will have a big impact on the gas and pipelining business of the West (p. 64) . . . More gas turbines have arrived at Ras Tanura for installation on Tapline (p. 69) . . . The Onassis-Nasser deal to build a pipeline paralleling Suez Canal is now off (p. 70).

PLUS THESE TECHNICAL FEATURES: A Journal report on Texas Eastern Transmission Corp.'s new developments in compressor-station techniques (p. 73) . . . and Pipeline Patrol's construction report (p. 121).

Gulf Unity Asked

Louisiana bids for united front in tidelands claims

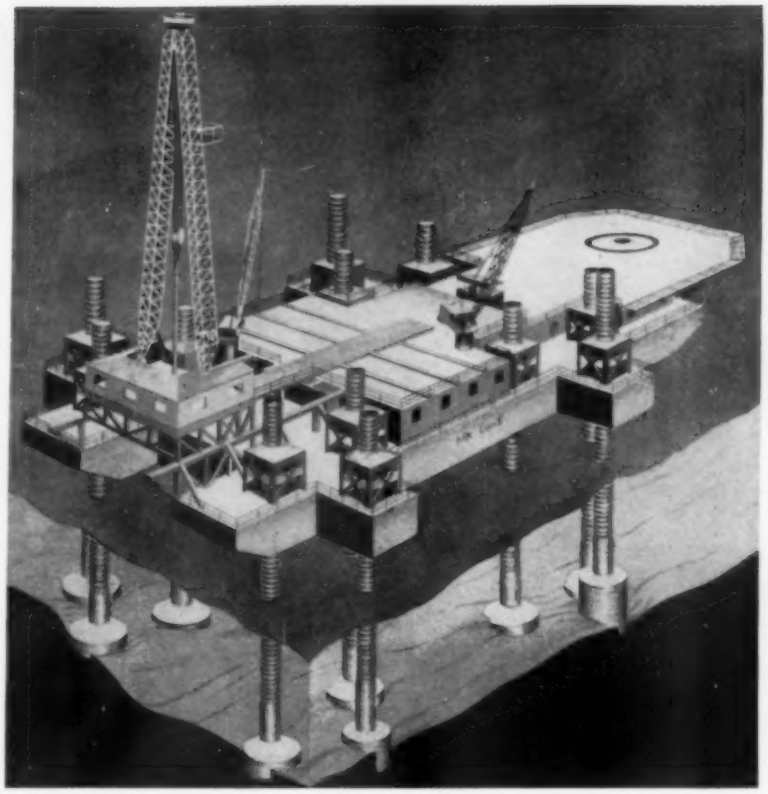
NEW ORLEANS.—Louisiana has appealed to other Gulf Coast states to join forces with it in pressing their claims to oil-rich lands under the Gulf of Mexico.

Jack P. F. Gremillion, Louisiana attorney general, met here last week with attorneys general of Texas, Mississippi, Alabama, and Florida. He urged concerted action in presenting their boundary claims to the U. S. Supreme Court.

The Supreme Court on June 24 postponed its decision in the Louisiana boundary case to permit other Gulf Coast states to intervene. Louisiana claims ownership of submerged lands 3 leagues into the gulf. The federal Government contends the boundary is only 3 miles beyond the low-water mark.

After the meeting, however, it appeared doubtful that state officials would present a solid front before the Supreme Court. Texas, which already has filed one brief in the case now pending, has urged the court to limit its ruling to the Louisiana boundary.

Texas claims its boundary has extended 3 leagues from shore ever since it was a republic. The Texas claim appeared to have gained official recognition until the Louisiana case went to court.



"Mr. Louie": Universal Drilling Co.'s new offshore drilling barge, "Mr. Louie," featuring a double-locking hydraulic jack, will be ready for delivery by the end of December. The $3 million mobile barge is unusual because of the jack design, which eliminates friction clamps, slips, and pins. The barge is raised in 4-ft. strokes by pairs of hydraulic jaws which alternately open and close between 8-in. concentric steel bands welded to the caissons (OJG, March 18, p. 100). Picture shows the 12 caissons supporting the single-hull barge for drilling in 120 ft. of water.

Hermosa Beach Asks Bids

HERMOSA BEACH, Calif.—This Santa Monica Bay community has called for bids for oil and gas development of its onshore properties.

The bid specifications call for a cash bonus, a flat 16⅔ per cent royalty, the usual soundproof rig, and landscaping and subsurface completion equipment now common in the Los Angeles Basin. Drilling will be conducted from 10-acre sites with one rig per site.

The city council recently accepted a joint bid of $11,100,000 by Shell Oil Co. and Continental Oil Co. for offshore drilling and development rights at Hermosa Beach.

Prolific Strike Completed

MIDLAND, Tex.—Continental Oil Co. has completed an important oil discovery in Andrews County, West Texas.

The 1 T. F. Teague flowed oil at the rate of 1,345 bbl. per day through a ½-in. choke from perforations in the Wolfcamp formation at 8,783-8,823 ft. Total depth was 13,520 ft.

The discovery is in the North Wemac area about 3 miles east of Andrews, Tex. Nearest production is about 2 miles south of the discovery.

Sulfur Deal Wins Approval

WASHINGTON. — Freeport Sulphur Co. has an agreement to work sulfur deposits on seven leases held by Humble Oil & Refining Co. on 35,000 acres on the outer Continental Shelf.

Interior Secretary Fred A. Seaton approved the move after the Justice Department said the agreement does not violate antitrust laws.

Freeport has agreed to complete a core-testing program and begin operations by November 1, 1958. The development program, approved by the Geological Survey, splits the sulfur deposits into three areas.

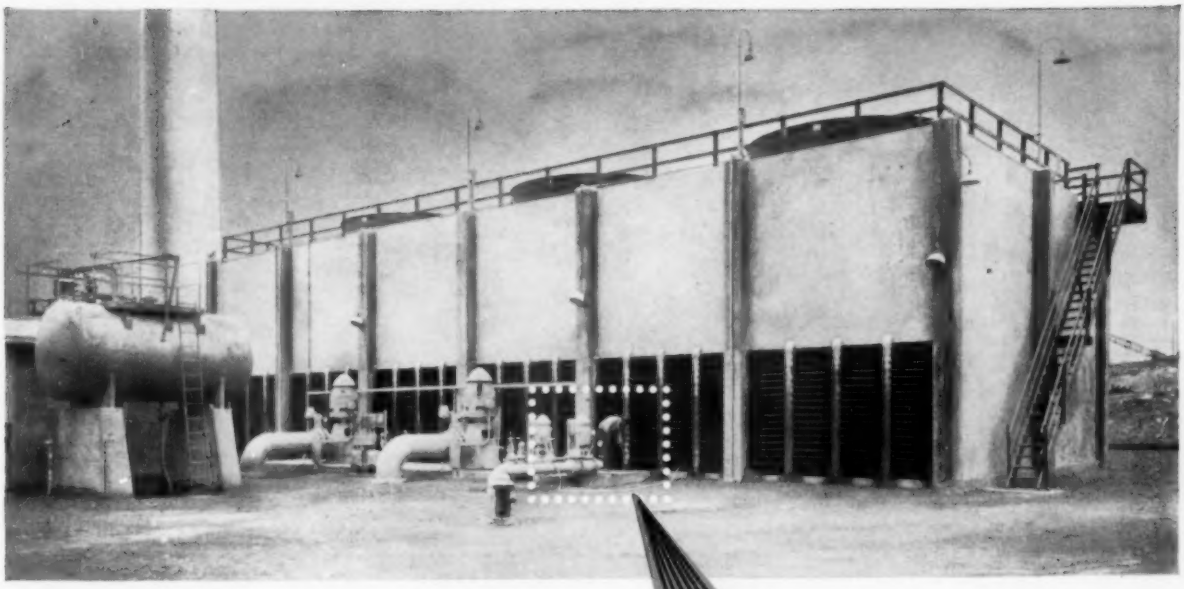
Five of the seven leases will be unitized for development of one deposit. The area is about 6 miles off the Louisiana coast, with the deposits under some 45 ft. of water.

Montana Gas Sells Pipeline

BUTTE, Mont. — Montana Power Co. has purchased gas transmission facilities, production properties, gas rights, and contracts of Montana Gas Corp.

E. J. Corette, president of Montana Power, said the facilities include 28 miles of 6-in. line connecting the towns of Havre, Chinook, Harlem, and Fort Belknap with the Bowes and Box Elder fields, plus seven 100-hp. compressors in Bowes and two in Box Elder.

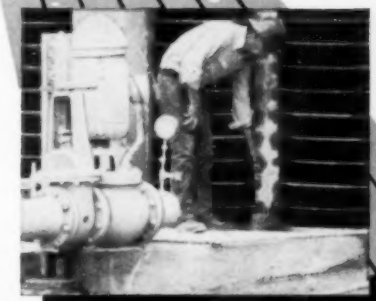
Corette said the purchase was made to "insure a dependable source of supply" for the towns on the line. He said Bowes field is seriously depleted and Box Elder field is "completely" depleted.



Unusual Cooling Tower

gets proven *Nalco* protection

This unusual cooling tower was built for the Riverside Cement Company at Oro Grande, California. The advanced design provides for concrete exterior walls which support and enclose fan units and redwood interior cooling vanes . . . The entire "working sections" of the tower can be repaired or replaced without affecting the structural strength of the shell. Nalco System Treatment protects this cooling system against scale and corrosion — has protected it effectively since it was first put in operation over two years ago. You can get the same complete water treatment protection, promptly, from Nalco. Write for details.



Method of feeding Nalco stabilizing treatment to this system is simplicity itself. Formula is supplied in ball form. Once each shift a perforated tube suspended in the tower basin is filled with balls which slowly dissolve in the cooling water.

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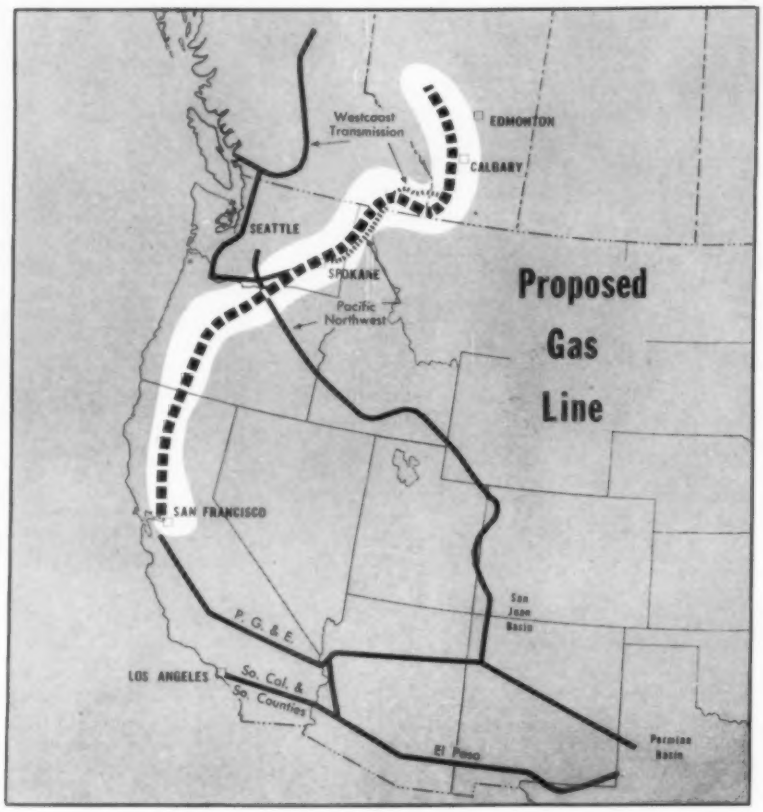

P.G. & E. line will mean:

More Canada Gas to U.S.

SAN FRANCISCO.—Canadian gas has assumed an even larger role in the United States supply picture with the disclosure of plans for the oft-predicted third gas line from western Canada.

The 1,300-mile, 36-in. pipeline which Pacific Gas & Electric Co. plans to build from Alberta to the San Francisco area (see map) is also important for other reasons. This $330-million project, which envisions delivery of 400,000,000 cu. ft. daily of gas starting in 1960, will mean:

. . . P.G.&E.'s entry into interstate transportation of natural gas. It gives the company greater control over its supply of non-California gas, which amounts to two-thirds of its requirements. El Paso Natural Gas Co. is now the sole out-of-state supplier of the California market.

. . . A bargaining lever for P.G.&E. in dealing with the combine of Westcoast Transmission Co., Ltd., Pacific Northwest Pipeline Corp., and El Paso, through which it already has access to Canadian gas.

. . . Sharper competition for Alberta's uncommitted gas reserves. This has bid up the price paid to producers to record levels for Canada. The improved prices and greater demand will spur development and exploratory drilling in western Alberta, where numerous discoveries are shut in.

. . . A fresh look at the Canadian supply and demand picture by the new "Canada first" government in Ottawa, which must spell out a policy on gas exports.

P.G.&E. plans . . . P.G.&E. has organized a wholly owned subsidiary, Alberta & Southern Transmission Co., which has purchased considerable gas reserves in the foothills area. Negotiations for additional reserves are in progress.

P.G.&E. may be joined by other companies in the venture. Southern California Gas Co. and Southern Counties Gas Co., subsidiaries of Pacific Lighting Corp., now share with P.G.&E. the gas delivered by El Paso to the California border.

These companies, which serve Los Angeles and southern California while P.G.&E. serves central and northern California, including San Francisco, have been offered 50 per cent of the gas from the new line. If they accept, they may become partners in the project.

Northwestern Utilities, Ltd., of Edmonton, and Canadian Western Natural Gas Co., of Calgary, are cooperating and may also participate in Alberta & Southern Transmission. Securities will be offered to the public in the U. S. and Canada. An undetermined portion of the capital will be supplied by P.G.&E. and other companies which may be brought in.

Bechtel Corp., which engineered and supervised construction of the Trans Mountain crude pipeline from Edmonton to Vancouver, known as the world's toughest pipeline job, will have the same role in the P.G.&E. project.

Supply source, prices . . . The proposed route of the pipeline will traverse an area in which there are some 40 significant gas discoveries.

There are a dozen proved or semi-proved gas fields. Most remain uncommitted. They extend from the U. S.-Alberta border to the Whitecourt region, west of Edmonton.

The major fields in this area dedicated to other lines are Pincher Creek, Nevis, Homeglen-Rimbey, and Savanna Creek. Savanna Creek is the chief source for the 174-mile, 30-in. line to the Pacific Northwest system (see map), which Westcoast hopes to build next year. The others are dedicated to Trans-Canada, whose 2,250-mile system from Alberta to Montreal will be completed next year.

Earlier this year Phillips Petroleum Co. announced a contract with Westcoast for its Savanna Creek gas starting at 10¼ cents per M.c.f., compared with 10 cents for Trans-Canada. The price would escalate to 19 cents, then increase another cent when deliveries reach a certain level.

Phillips called these prices the best yet paid in Canada. But these levels have been eclipsed in recent months. Competition between P.G.&E. and the El Paso-Westcoast team has raised the starting price as much as 5 cents.

This means Canadian gas delivered in California will be more expensive than the New Mexico and Texas gas which now makes up the bulk of the state's supply. But there is no question about the need for bolstering reserves to meet the demand of this fast-growing market in the United States.

Legal hurdles . . . The Alberta Oil and Gas Conservation Board will be asked, probably next month, for an export

permit. Approval of the project also will be required by Canada's Board of Transport Commissioners, the Federal Power Commission, and the California Public Utilities Commission.

The Alberta board is not expected to be a major problem. But this agency, like the federal board, must satisfy itself that the reserves required by P.G.&E. will not result in a future shortage for the province.

P.G.&E. has the major Alberta gas companies on its side. Northwestern Utilities and Canadian Western Natural point out the line will open up gas service to many communities along the route which alone do not provide enough market to justify a pipeline. They say this is the first time an export project has been undertaken on a basis that fully protects in advance the needs of Alberta utilities and customers.

Approval of the new Conservative dominion government may not come so easy. The Conservatives have made some oil men nervous by their statements on the gas-export issue.

Present Alberta reserves are sufficient to support four Trans-Canada pipelines. And at the present rate of growth, one estimate has placed the figure at 42 trillion cubic feet by 1986. This is more than double accepted 1957 estimates.

But the increased demand of Westcoast and Trans-Canada must be weighed against Canada's own demand. Combined design capacity of these two lines is 1,400,000,000 cu. ft. daily, and throughput will reach this level in a few years. Initial capacity will be just a beginning for these lines, and the same will be true for P.G.&E.

But the prospects for steadily growing reserves, plus the obvious advantages in using the U. S. market to help develop the Canadian gas industry, are expected to sway Ottawa.

The Federal Power Commission has already approved the principle of Canadian imports to supplement U. S. supplies. And the soundness of the project is unquestioned. The market is established, reserves are adequate, and the line should operate at a high load factor from the beginning. These facts combine to make an attractive investment and should assure financing on reasonable terms. The project will not be immune from opposition from U. S. pipelines, however.

Competition for El Paso . . . P.G.&E.'s plans were disclosed shortly after the company and the southern California utilities welcomed the possibility of a new source of supply. This new source would be a Four-Corners-to-California gas line proposal by Trans-Western Pipeline Co., jointly owned by Warren Petroleum Corp., Monterey Oil Co., and J. R. Butler, Houston consulting engineer (OGJ, July 8, p. 75).

There has been no suggestion that El Paso has not done a good job in meeting California's tremendous demand. But a second source was deemed desirable. Besides, on a line they would build themselves, the California utilities would profit from the transportation revenue and eliminate the middle man.

Canadian gas and the U. S. . . . Regardless of whether P.G.&E. builds the proposed line, Canadian gas is certain to become a factor in the U. S. supply from California to New York.

Westcoast Transmision will start operating this fall, funneling 200,000,000 cu. ft. daily to Pacific Northwest to supplement its San Juan and Rocky Mountain sources. These deliveries will increase to 300,000,000 cu. ft. daily after January 1, 1959. Pacific has contracted to buy an additional 350,000,000 cu. ft. daily later.

Canadian gas is due to enter the El Paso picture by 1959, through exchange of 100,000,000 cu. ft. daily with Pacific Northwest. Later Canadian gas is destined to reach California in increasing quantities through the Pacific-El Paso system. Officials have discussed two plans. One is reversal of the Pacific system, which now pumps gas north to Washington. The other calls for a new line from Pacific's system in Washington or Idaho directly into northern California.

Alberta gas could be flowing through the Midwest next year, provided the FPC approves the Trans-Canada-Tennessee Gas proposal which will be decided this fall. And this could be the first step in a long-range plan for Tennessee to introduce Canadian gas into the New York metropolitan area through Trans-Canada.

Journal Editor Wins Award of Merit

WILBUR L. NELSON, technical editor of The Oil and Gas Journal and professor of petroleum refining at the University of Tulsa, is the 1957 recipient of the award of merit presented by the American Association of Cost Engineers.

Nelson is pictured at left above receiving the award from A.A.C.E. President Norman G. Back. Presentation was made at the group's annual convention at the University of New Hampshire, Durham, N. H. Nelson is widely known for his authoritative refinery construction index and other cost studies of the petroleum industry which have appeared continually for years in The Oil and Gas Journal. His many articles on cost engineering also have been considered a major contribution to this growing field of study.

In addition to the award of merit scroll, Nelson was presented with a special slide rule made available by Keuffel & Esser Co.

Oil Firms Win Fight

Court tosses out Government's $66 million claim against Texaco and Socal in 5-year-old Marshall Plan price case

A FEDERAL District Court in New York last week rejected the U. S. Government's claim that Standard Oil Co. of California and The Texas Co. made too much money on shipments of Marshall Plan oil to Europe.

The decision, which came 5 years after the suit was filed and after 2 years of hearings, tossed out the Government's claim for about $66 million from the two companies and four of their marketing subsidiaries.

Actually the ruling of Judge Thomas F. Murphy has a much more far-reaching effect. It probably means that the Government will abandon similar suits against Standard Oil Co. (N. J.) and Socony Mobil Oil Co., and affiliates of each.

The total claims against all the companies amount to more than $200 million plus 6 per cent interest from 1952.

Suits were filed against the four major companies and their overseas marketing affiliates in August 1952. The Government accused each of overcharging the Economic Cooperation Administration and the Mutual Security Agency for Saudi Arabian crude supplied to Marshall Plan countries in Europe between September 1, 1950, and August 31, 1952.

Under the ECA and MSA, companies in Marshall Plan countries contracted for crude oil from the American companies after approval of their own governments. Because all the Marshall Plan countries were short of dollars, the purchasers paid their own governments for the oil in local currency.

This money went into a "counterpart fund" to be used locally in connection with the foreign aid program. The crude suppliers were paid for their oil in dollars by ECA and MSA under the terms of the aid program.

The prices involved . . . The essential point involved in the suit settled last week was the provision that no funds appropriated by Congress could be used to buy anything "at prices higher than the market price prevailing in the United States at the time of the purchase." The Government contended that the $1.75 per bbl. for Saudi Arabian crude f.o.b. Ras Tanura or $2.41 at Sidon on the eastern Mediterranean was not the "market price prevailing." Those prices today are $2.12 at Ras Tanura and $2.69 at Sidon.

The Government attacked the companies' pricing systems from several angles. The Department of Justice contended that because all four of the majors owned an interest in Arabian American Oil Co. and all gave themselves an "offtaker discount," they should have charged their European customers only $1.43 at Ras Tanura and $1.66 at Sidon.

The court said this was merely a figure which the four owners decided upon as "high enough to enable Aramco to carry on its development, yet low enough to give the owners a competitive advantage."

The Government also claimed that some sales were made for less than those prices posted at Ras Tanura and Sidon. In fact, there were charges that surplus Middle East oil was being "dumped" on the East Coast of the U. S. at prices $1.00 to $1.75 a barrel f.o.b. Ras Tanura. This, the Government contended, should have established a new and lower "prevailing market price."

Court's decision . . . The court rejected this theory with the comment that small movements of oil to points outside the major marketing areas of a supplier do not in general determine the prevailing market price.

Judge Murphy said in his 80-page decision he reviewed the highlights of evidence offered by the two oil companies and reached only one conclusion: The companies showed beyond any contradiction that the prices they received from ECA were the lowest competitive market prices.

He then dismissed the Government's suit.

A spokesman for the Caltex group of companies, jointly owned by the major defendants in the lawsuit, said that the companies were "gratified" that the court vindicated their position and "affirmed that pricing practices under the ECA program were fair and proper."

Real Cool: Some of the heat will be taken off desert drilling when this rig goes on location in Libya under contract to Mobil Oil Co. of Canada, Ltd. The engine house and drilling floor will be air conditioned by six evaporative coolers using well water. The drilling floor is open at the top, but walled in with sheet steel. The engine house is completely enclosed. The system is designed to cool the areas to 80° while outside temperatures range up to 130°. S&R Tool & Supply Co. of Houston, which assembled the unit for Camdrill International, Inc., believes it is the world's first air-conditioned land rig.

Britain Plans Atom Tanker

BRITAIN WILL BUILD the first atom-powered tanker if plans of two companies are carried out.

The ship would be at least 65,000 tons and, they say, capable of carrying cargo more cheaply than a conventional ship of comparable size.

The companies are John Brown & Co., builder of the Queen Elizabeth and Queen Mary, and the Hawker Siddeley Corp., plane manufacturer.

While the ship is not yet on the drawing boards, more than a year of investigation has convinced them of its ultimate success.

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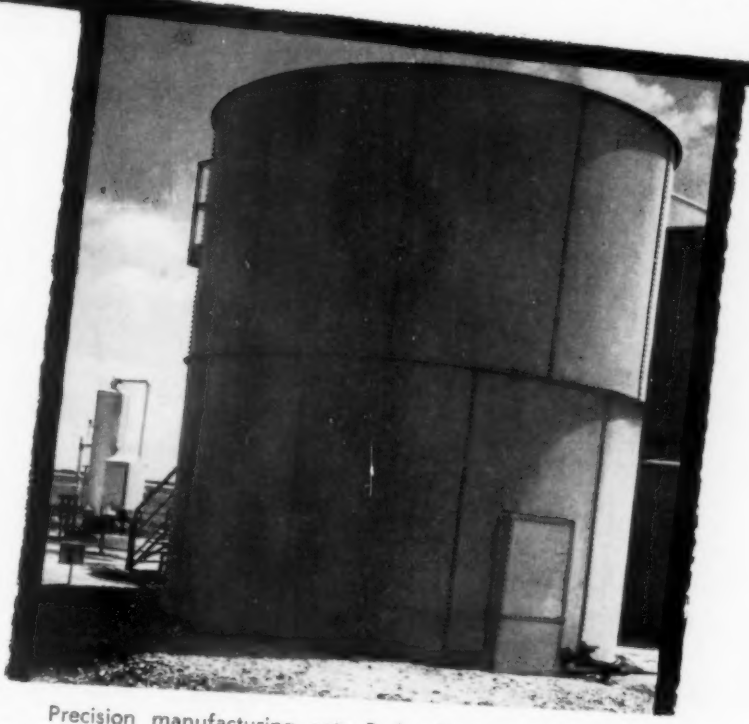

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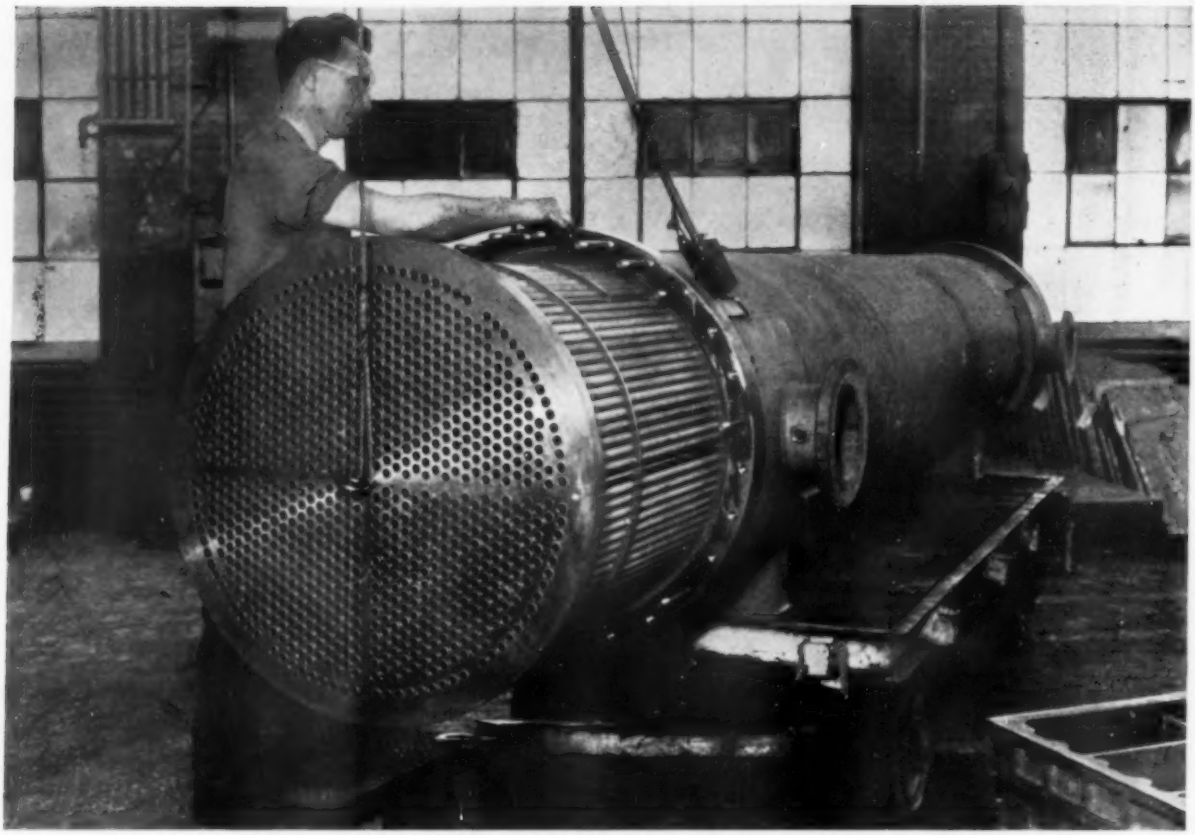


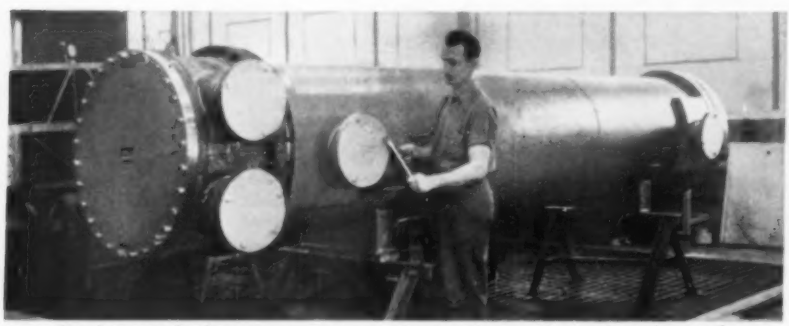
Tube bundle partially removed from shell of General Electric heat exchanger. Fixed-end tube sheet is Ambraloy-917, one of The American Brass Company's aluminum-bronze alloys. Tube sheet is 36⅜" diameter, 2" thick.

Thick, rolled circles of Anaconda Aluminum Bronze available for high-strength tube sheets

Where superior strength and corrosion resistance are required in heat-exchange applications, the use of *rolled* circles of Ambraloy-917 for the tube sheets offers appreciable savings in material cost compared to circles produced by the forging process. The American Brass Company can furnish Ambraloy-917 in rolled circles up to 5" thick, maximum diameters are governed by thickness.

Anaconda sheets, plates and circles are available in a wide range of alloys and sizes for heat-exchange service in marine and stationary-steam power plants, oil refineries and other process industries. Produced by the rolling process, they are commercially flat, accurate in dimensions and are free from the surface imperfections and porosity often prevalent in cast plates. The American Brass Company makes plates for condenser tube sheets of copper and several copper alloys in rectangular sizes up to 156 inches in width and weights up to 15,000 pounds for any shape that can be cut from such sheet. The maximum standard limits for circles are 160 inches in diameter and 11,000 pounds in weight. Half-circles can be produced up to 13,000 pounds in weight.

Special jobs. When specifications call for extremely large plates for special applications, The American Brass Company will gladly cooperate in the solution of such problems. For further information on Anaconda Condenser Tubes or Tube Sheets write: The American Brass Company, Waterbury 20, Conn. 3785



Completed General Electric water-to-water heat exchanger for cooling the condensate recirculated through the hydrogen coolers of a 427,500-kva cross-compound turbine-generator unit. Water box cover is also Ambraloy-917, 36½" diameter and 2⅜" thick.

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A partnership offer is the wedge . . .

Oil Firm Tries for Indonesia

A CALGARY-BASED company is making a three-way deal that may put it in the oil business in Indonesia within 6 months.

New British Dominion Oil Co., owned largely by United States stockholders, still faces the obstacle that has curtailed exploration by major companies. The government has been unwilling to grant new oil exploration or development concessions.

But the Canadian firm has asked stockholder approval of a plan it hopes will result in the first concession grant in 6 years.

Thomas L. Brook, chairman of New British, said "though substantial risks are involved, the venture will be well worth while. . . ."

His company could be betting that it will succeed where others—Caltex, Standard-Vacuum Oil Co., and Royal Dutch-Shell—have failed, because its plan would bring in Indonesian nationals and the government as partners.

The deal . . . New British Dominion, pending stockholder approval this month, will acquire 49 per cent interest in Nusantara Mining Corp. from Baud Corp., N. Y., of The Hague and Djakarta. Baud is a wholly owned subsidiary of Sea Oil & General Corp., of New York.

Of the remaining Nusantara stock, 50 per cent would be held by Indonesian citizens for disposal to the government under a partnership arrangement.

British Dominion, in return, would turn over 4,000,00 shares or 50 per cent of its own stock to Baud and Sea Oil. It also would change its name to Asamera Oil Corp., Ltd.

Nusantara holds exploration licenses on 2,250,000 acres in Sumatra, Borneo, and Java. If work on the licenses is promising, the holder can apply for an oil exploration license. Some Nusantara blocks already are under application.

The hitch is that the government has not granted new exploration concessions since 1951 when parliament banned them pending passage of a new oil law. The new law is yet to be passed.

The financial end of the deal was made with Empire Resources Corp., a subsidiary of Empire Trust Co. and Shearson, Hammill & Co., both of New York.

These firms will have a 6-month option to firm up an exploration, development, and exploitation concession over a 720,000-acre block in the Palembang region of Sumatra.

The northwestern part of the area is straddled by Royal Dutch-Shell production on the north and northwest. DeGolyer & MacNaughton, Inc., said the block has a reasonable chance for commercial production.

In the event no agreement with the government is reached, New British Dominion will reimburse Empire and Shearson for out-of-pocket expenses. If a deal is made, the financial firms will each have a 5-year option to buy 400,000 shares of the company for $2.70 each.

Pavilion Wrecked, Arabs Are Happy

STANDARD VACUUM OIL CO. has opened a new $1,100,000 bunkering terminal at Aden on the southern tip of the Arabian Peninsula. The opening ceremonies occurred under the best possible conditions in the Arab world—but probably the worst anywhere else.

The guests, including the governor of the British Colony, Sir William Luce Knight, were assembling for the event when a sudden sandstorm wrecked the dedicatory pavilion and sent bunting flying in all directions.

Everyone was extremely uncomfortable except the Arabs, who said the storm was a good omen for the terminal's future. To them it meant coming rain.

Turbines Going In

Units to add 105,000 bbl. daily to Tapline capacity

THE SECOND AND THIRD of six 5,000-hp. combustion gas turbines to be installed on the Trans-Arabian pipeline system have arrived at Ras Tanura.

One of the 123-ton units, plus a 77-ton control unit, is being installed at Jalamid, between Badanah and Turaif.

The other will operate at Shuba, between Qaisumah and Rafha.

The crude-burning turbines will be the heart of an expansion program designed to raise capacity of the 1,068-mile system from 330,000 bbl. to 435,000 bbl. daily.

The first turbine went into operation earlier this year as an auxiliary pumping unit set on permanent foundations at Wariah. It helped Trans-Arabian Pipe Line Co. deliver a record 380,000 bbl. daily from its terminal at Sidon, Lebanon, in May.

Four more turbines are due to arrive within a few weeks. Three will be installed. The fourth is a spare.

Cataract Expands in Panama

CATARACT MINING CORP. of New York can lay claim to the title of the largest holder of oil exploration concessions in Panama.

Cataract has acquired another 3,000,000 acres of concessions in the provinces of Veraguas, Bocas del Toro, and Chiriqui.

The mining concern already had more than 2,000,000 acres of Panamanian lands under concessions through its subsidiary, Cia. Catarata de Petroleo Panama, S.A. The major part of this acreage is being worked under joint development contracts.

Next Week . . .

. . . What Lies Ahead in Second Half

DRILLING is heading toward a healthy upswing in the second half.

This important segment of the oil industry has experienced an abnormally bad run of business in the first 6 months of 1957. But its volume should jump by nearly 4,000 more wells in the next 6 months.

The annual Midyear Review and Forecast Issue of The Oil and Gas Journal to be published next week will show this break-down on drilling gains:

. . . **Wildcats**—up 1,072 wells in second half.

. . . **Development wells**—up 2,840.

This adds up to 3,192 more wells for the second half than were drilled up to July 1. It will be reflected in a footage gain of 14.8 million feet over the next 6 months.

Other trends, statistics, and forecasts for drilling and other segments of the oil industry in 1957 also will be featured in this authoritative midyear review issue.

McCarthy Sells Out

T.G.T. combine takes over in Bolivia, plans drilling

FOUR U. S. COMPANIES which have taken over the 900,000-acre Bolivian concession formerly held by Glenn McCarthy plan to start drilling there within 4 months.

Chaco Petroleum, S. A., will be operator for the group headed by Tennessee Gas Transmission Co. The combine announced last week that it had closed the deal for the acreage on which it had acquired an option several weeks ago.

Tennessee Gas, parent company of Chaco Petroleum, has a 35 per cent interest in the Bolivian concession. Union Oil & Gas Corp. of Louisiana and Lion Oil Division of Monsanto Chemical Co. have 25 per cent each. The remaining 15 per cent is held by Murphy Corp.

The new combine also completed purchase of equipment in Bolivia owned by McCarthy and two companies which he headed—Glenn McCarthy, Inc. and Glenn McCarthy de Bolivia, S. A. The McCarthy group surrendered all rights or claims to the concession.

McCarthy and his companies received $1,500,000 in cash. They are to receive a like sum in the future if oil and gas are produced and can be marketed from the Bolivian acreage.

The new owners have paid the Bolivian Government agency, Yacimiento Petroliferos Fiscales Bolivianos, an undisclosed sum in advance royalties and taxes.

Gulf Enters Africa

To spend $60 million in 5 years on Angola concession

A GULF OIL Corp. subsidiary will look for oil in a small and obscure piece of Portuguese territory on the west coast of Africa.

The Portuguese Government revealed in Lisbon last week that it will award Gulf a concession over the Cabinda region of Angola. Gulf has agreed to spend 177 million escudos (about $60 million) on its exploration program within the next 5 years.

The work will be done by Cabinda Gulf Oil Co., a Gulf subsidiary to be set up in Portugal with headquarters in Lisbon. The province of Angola will have a 20 per cent interest in the company and will share any profits equally with Gulf.

Cabinda is a narrow finger of land extending from West Africa's coast inland between the Belgian Congo and French Equatorial Africa. It is a part of Angola, but is separated from the province by a narrow neck of the Belgian Congo.

The region which Gulf will explore is about 250 miles north of Luanda where Cia. de Combustiveis Do Lobito Purfina plans to build a 10,000 to 20,000 bbl. refinery.

The refinery is the result of an exploration program which led to the discovery of a field at Benfica which is now being developed by the affiliate of the Belgian company, Cie Financiere Belge des Petroles (Petrofina).

Suez Line Out

Onassis won't build line, enters Japan tanker deal

ARISTOTLE ONASSIS, the Greek shipping magnate, faded from the Suez pipeline picture last week, but bobbed up again half way around the world in a major tanker-building scheme.

A spokesman for the Egyptian finance ministry says his government has rejected an Onassis proposal to finance a crude-oil pipeline paralleling the Suel Canal. He said Egypt will build the line herself without Onassis money.

Beyond this point the spokesman was just a little vague. Reports from Cairo said Egypt had decided to ask for international construction bids for the pipeline, but just when is still uncertain.

Onassis first proposed building a crude line across the neck of Egypt almost 2 years ago to carry oil shipped in new supertankers that have too much draft to travel the canal. It would mean storage and loading facilities at both ends of the 100-mile line.

The shipping magnate offered such a pipeline as the answer to meeting European oil needs while the canal was shutdown late last year. Then little more than a week ago, the Egyptians conceded for the first time that they were discussing the deal with Onassis (OGJ, July 8, p. 86).

Apparently undaunted by this Egyptian rebuff, Onassis turned up during the same week in the news from Japan.

The Kawanami Shipbuilding Co. at Osaka said it has made a provisional contract with Onassis interests to build five 100,000-ton tankers. The shipbuilding company went into liquidation several years ago, but said its contract with Onassis called for an advance payment of 20 per cent of the entire shipbuilding program's cost. This would pay off creditors and put the firm back in business.

———*World* briefs

The Italians are claiming the deepest well in Europe. Press reports from Rome credit Azienda General Italini Petroli (A.G.I.P.) with drilling a 17,224-ft. well at Piadena near Dremona in the Po River Valley. Exploration rights in the area are the exclusive property of the government-owned company. The announcement said the well is in "perfect condition." But it neglected to mention whether oil or gas had been found.

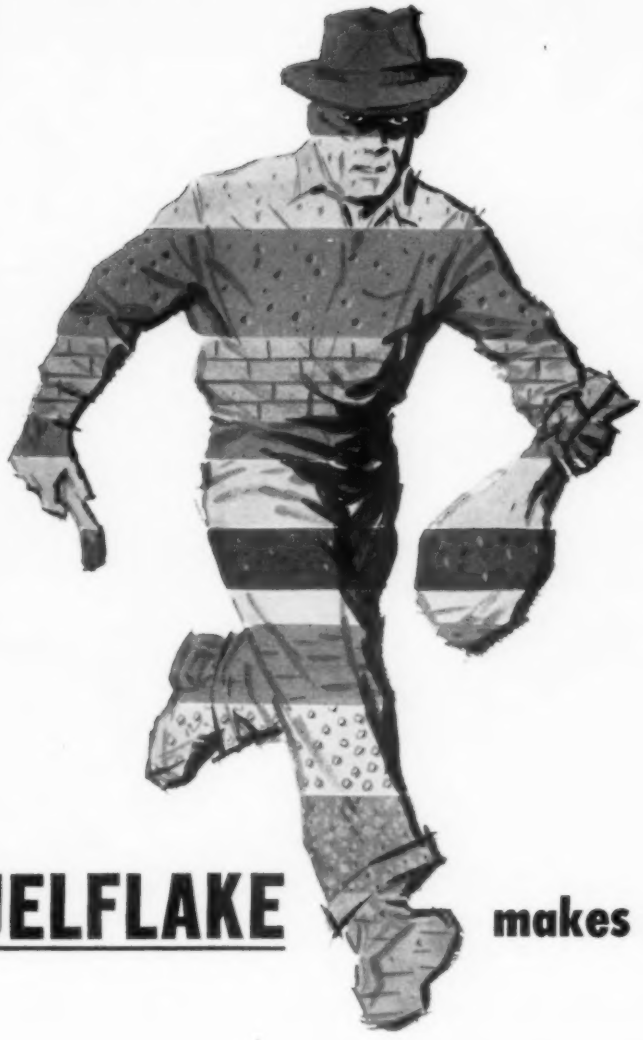
Ste. des Petroles de Valence will drill its first deep test in Luberon, north of Marseilles, this fall. It also will drill a second test in Valence Basin at Montmiral. The first well was at St. Lattier. The British Petroleum Group has half interest in the company. B.P. also has half interest in Ste. des Petroles du Senegal, which hopes to stake a location for a deep test in southern Senegal in French West Africa later this year.

The Greek Government has received six bids for operation of its nearly completed 30,000-bbl. refinery at Aspropyrgos, near Athens. Bidders were Hydrocarbon Research, Inc., whose German affiliate is building the plant; Socony Mobil Oil Co.; Helios Co.; Elvin Skouras Pappas; Athens Restis; and National Bank of Greece.

West German companies have made two more discoveries near salt domes. The 1 Meckelfeld-Sued, 1½ miles south of Meckelfeld field, tested at the rate of 150 bbl. daily from 6,232 ft. It was drilled by Wintershall A.G.-Gewerkschaft Elwerath. The 2a Warnau, 9 miles west of Ploen, flowed 30 bbl. daily of light crude from 8,168 ft. Deutsche Erdoel A.G. and Elwerath made the test.

Deutsche-Shell A.G. expects to complete expansion of its Hamburg-Harburg refinery next year. It is increasing capacity from 19,500 bbl. daily to 52,000 bbl. daily at a cost of $59,000,000. Shell also has under construction an 80,000 bbl. daily plant near Cologne.

ANIC's 14,000-ton styrene monomer plant at Ravenna, Italy, will be built by Ste. Belge de l'Azote et des Produits Chimiques du Marly (S.A.B.) The styrene will be used at ANIC's 55,000-ton synthetic-rubber plant now under construction. A Koppers Co., Inc., process will be used in producing the styrene.



Stop thief formations!

JELFLAKE makes mud money go farther

Many operators make a routine practice of adding Jelflake® to their drilling mud. A few sacks of this inexpensive lost-circulation material help avoid mud loss *before* it occurs. Many porous formations and fractures that might steal costly drilling fluid are readily sealed off with the use of Jelflake.

Jelflake, the fragmented plastic foil developed by Dowell, is made up of crinkled particles of various sizes. This allows the smaller bits to plug formation pores, while the larger fragments flatten out on the surface wall to provide a fast, effective seal.

Jelflake is available in strong, wetproof bags at major mud distributors and local Dowell stations. For more information, call any of the 165 Dowell offices in the United States and Canada; in Venezuela, contact United Oilwell Service. Or write Dowell Incorporated, Tulsa 1, Oklahoma.

Services for the oil industry

DOWELL

WORLD'S MOST MODERN REFINERY — Tidewater Oil Company's new Delaware Refinery, 15 miles south of Wilmington, represents the most advanced thinking of refinery engineers and technologists.

LOW-COST WATER AND SOLIDS REMOVAL—A BASIC FOR MANY REFINING AND PETROCHEMICAL PROCESSES

Separator/Filters have multiple uses

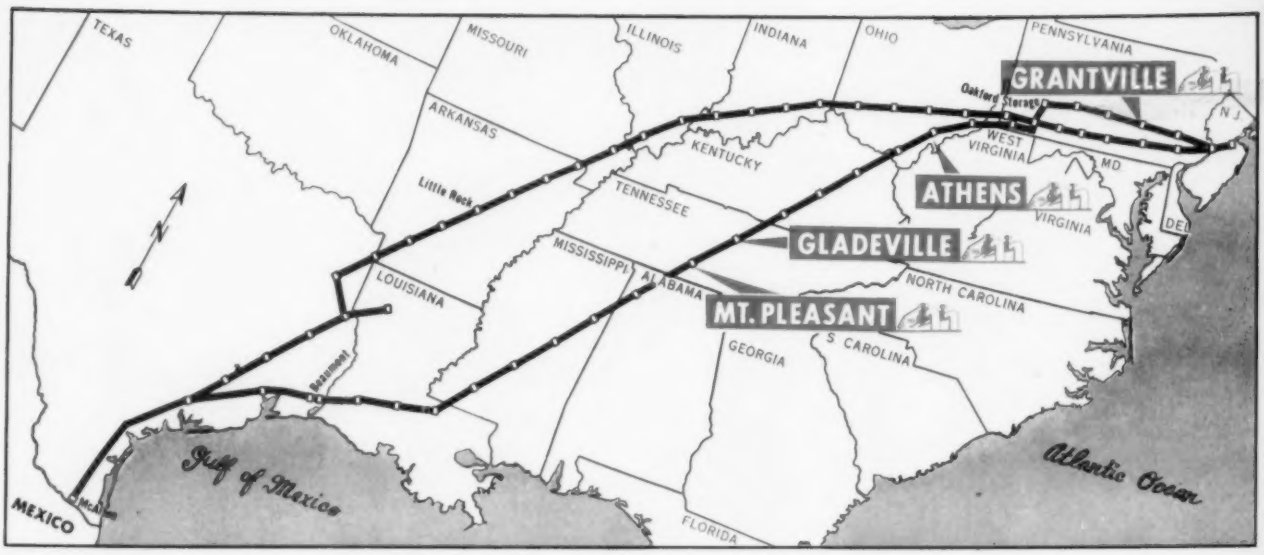
Applications — In today's modern refineries and petrochemical plants, many processes are highly dependent upon low-cost removal of water and solid contaminants. Fram-Warner Lewis water separator/filters are extensively employed in process applications because their use provides the benefits of improved feed preparation, reduction in catalyst consumption, lower corrosion rates, and water free products.

Products Handled — LPG, gasoline, naphtha, distillate, gas oil, aromatics.

Special Uses—Feed stocks, treated and water-washed products, finished products to storage.

Description — Fram-Warner Lewis separator/filters offer a flexibility of design to meet a variety of process applications — Vertical single stage, horizontal single stage, horizontal two stage separator/filters with entrained water removal efficiencies of 90 to 100% and filtration efficiency down to 5 microns particle size. Engineering design and pressure vessel fabrication facilities at Warner Lewis Tulsa plant are always available to handle special problems to customer specifications. Let proven experience in the field in countless process applications help you.

For Further Information — Write Process Section Warner Lewis Company, Division of Fram Corporation, Box 3096, Tulsa, Oklahoma, for Process Manual on water separators/filters. Warner Lewis representatives are located throughout the United States and Canada and they will be glad to contact plant processing and operating personnel. (Adv.)



Four Texas Eastern stations unveil . . .

JOURNAL TECH-REPORT

Newest Compressor-Station Techniques

FOUR STATIONS—Mount Pleasant, Gladeville, Athens, and Grantville—exemplify recent advances of Texas Eastern Transmission Corp. in the development of centrifugal-compressor techniques.

There are two significant types of large power units at these four stations—the 15,000-hp. single electric motor and the gas turbine in 5,000 and 7,600-hp. units. These two entirely different types of drive meet a wide range of gas-transmission conditions. Consequently, together they give much versatility to the centrifugal compressor by making possible large concentration of power for a variety of transmission situations.

These larger units are becoming attractive because of lower investment per horsepower, simplicity of design and operation, and adaptability for future remote control.

There is a definite trend toward more use of centrifugal compressors. But both types of drives—large motor and gas turbine—have their places as power units. Neither one is considered superior for all conditions. Each one has advantages of its own.

When selecting equipment for a new station, the advantages of the electric or gas turbine driven centrifugal compressors are weighed with those of the reciprocating compressor units with higher investment costs ($250 to $300 per installed horsepower) but with flexibility for handling varying loads. Furthermore, reciprocators are available for earlier delivery.

In choosing a type to meet the strategic objectives of the company, the benefits promised by simplicity of design and operation often outweigh small margins of differences in efficiency.

The gas turbine is at its best for gas transmission of winter peak loads between underground storage fields and metropolitan markets (Example: Grantville station). But the low investment cost and simplicity of the turbine are also desirable for transmitting into underground storage at a high load factor the year around, (Example: Athens station with investment of $199.11 per horsepower).

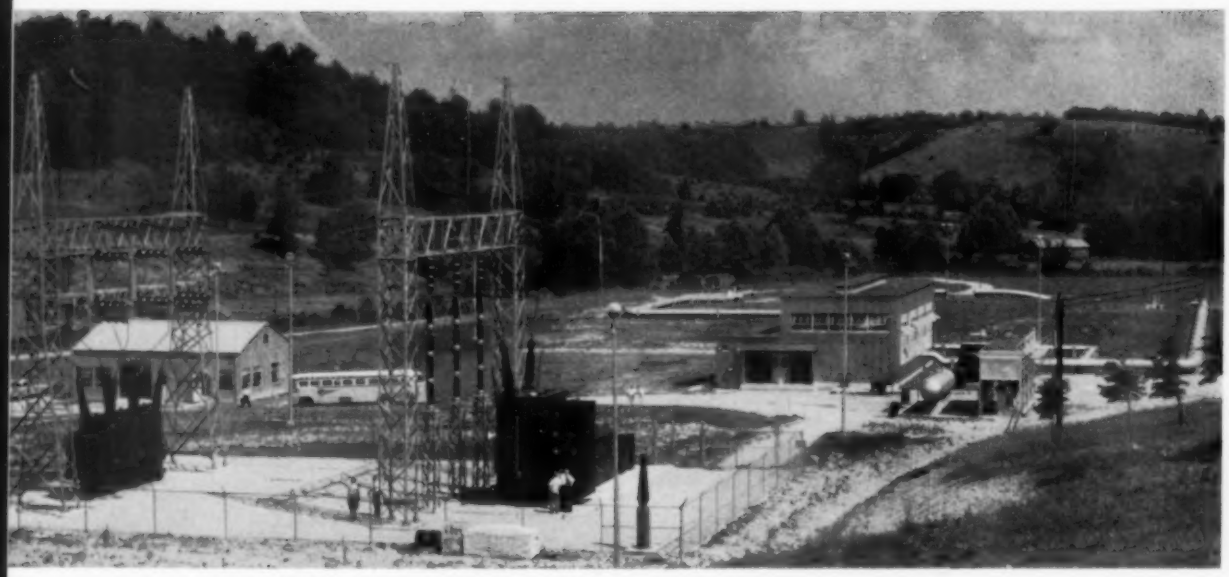
For transmitting into storage at high load factors the big 15,000-hp. electric motor with low investment is attractive where low-cost and abundant power is available (Example: Mount Pleasant station with investment of $114.04 per horsepower). Comparison of the single-unit 15,000-hp. electric station at Mount Pleasant with the 6-unit 15,000-hp. station at Gladeville shows the advantages of simplicity accomplished by large power unit concentration.

Texas Eastern initiated the high-pressure centrifugal compressor 10 years ago. These four stations now point to the progress in the art of developing centrifugals for gas transmission which is now growing in importance.

Design and construction details of the four stations are presented in the next seven pages.

. . . an on-the-job report by the Journal's pipeline editors

Paul Reed, pipeline editor, with Baxter D. Goodrich, vice president and chief engineer (left), and George H. Ewing, supervisor of plans and research, with Gene T. Kinney, assistant pipeline editor (right), on a 4-day airplane tour of Texas Eastern stations from Shreveport, La., to Harrisburg, Pa., to procure material for this section.



1. MOUNT PLEASANT STATION . . .

. . . "Ultimate in Compactness, Efficiency"

THIS STATION, which is identical to two others on the Kosciusko-Oakford main line, relies on a single 15,000-hp. electric motor as prime mover.

The synchronous type of motor employs across-the-line starting, rather than reduced voltage. This is possible because of the sizable electric capacity available.

The motor drives a single-stage compressor through a 900-6,506 r.p.m. speed increaser. The compressor develops a record 1.5 compression ratio for single-stage centrifugal units. This compressor handles about 680 M.M.c.f. of gas daily, doing the same work as six compressors on the next upstream station.

The station is the ultimate in compactness and simplicity. The main building is 24 ft. by 55 ft. 6 in. and the control room is 22 ft. by 18 ft. 6 in., one-third the size of a six-unit station of the same horsepower.

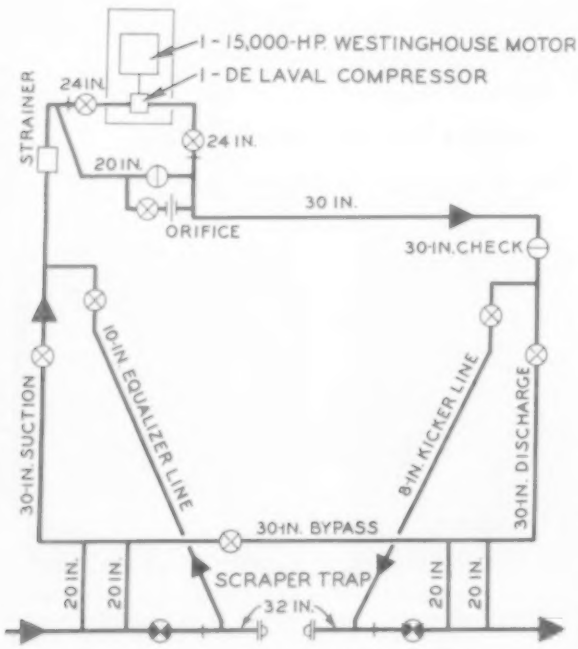


DIAGRAM of piping for single-unit electric station.

COSTS, MANPOWER

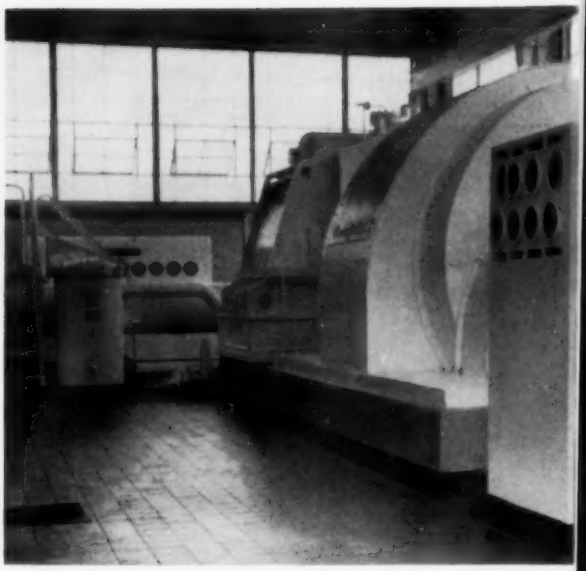
Station cost		$1,710,530.00
Cost per horsepower		114.04
Station personnel	1 chief operator	
	4 operators—1 per 8-hour shift	
	1 relief operator	
	1 mechanic's helper	
	1 maintenance man	
Total	8	

Significance

The biggest package of power in a single unit for any pipeline operator is the 15,000-hp. motor of the type developed for three stations exemplified at Mount Pleasant, Tenn. The creation of this entirely new type of centrifugal station—completely different from any previous one—provides new possibilities for gas transmission.

Economies from such concentration of power and resulting simplicity of design and operation bring the lowest installation investment and operating costs per horsepower. This type of station will be valuable where abundant electric power can be had at low rates. This will be particularly true for conditions like those of high load factor through-

CONTROL CONSOLE behind the new "black box" electronic equipment developed for sensing approach of critical frequencies characteristic of surge conditions.



A 15,000-HP. synchronous motor drives single-stage centrifugal compressor through speed increaser. In the background is panel on auxiliary console unit.

out the year existing on this line delivering to Oakford storage. Gas fuel costs are increasing while the trend in electric-power rates in recent years has been more stable.

Motors of 2,000 and 3,000 hp. are not uncommon on trunk pipelines. A 6,000-hp. motor was installed on a distribution system 3 years ago but the 15,000-hp. units at Egypt, Mount Pleasant, and Tompkinsville stations of Texas Eastern are by far the largest in pipeline service. To achieve this large size, a departure was made from the usual induction motor with efficiency of 96 per cent by going to the synchronous type of motor—unusual for pipelining—with efficiency of better than 98 per cent. With this there is used the first stepup gear (98 per cent efficiency) for an electric motor in pipelining. Frequently 16,000 hp. is procured from this 15,000-hp. type of motor.

By eliminating scrubbers and by using a slanting-screen strainer, instead, $100,000 is saved in initial investment.

All savings together give the lowest station costs in gas transmission per installed horsepower.

STATION EQUIPMENT

Prime mover ..... Westinghouse Electric Corp. 15,000-hp. synchronous electric motor, type HG coupled. Voltage 4,160, amp. 1,580, 3 phase, 60 cycle, 900 r.p.m. Totally enclosed, force ventilated with exciter-exciter voltage 125 d.c., power factor 100 per cent, service factor 1.15.

Speed Increaser ..... Westinghouse Electric Corp. Type SU 42—34 XSP 17,250 hp., 900/6,506 r.p.m., ratio 7.229—to provide compressor high speeds.

Gas Compressor ..... De Laval Steam Turbine Co. 15,000-hp. single-stage, single suction, overhung 35½-in. diameter impeller. Unit has 24-in. flanges and adjustible inlet guide vanes.

Station surge control . . . An 8-in. recycle line situated around the 20-in. bypass check valve is equipped with an electrically operated plug valve. This provides an electrically controlled compressor recycle system which may be set manually at any setting desired to increase the mass flow through the compressor and relieve compressor surges during startup, stopping, and unstable periods of operation.

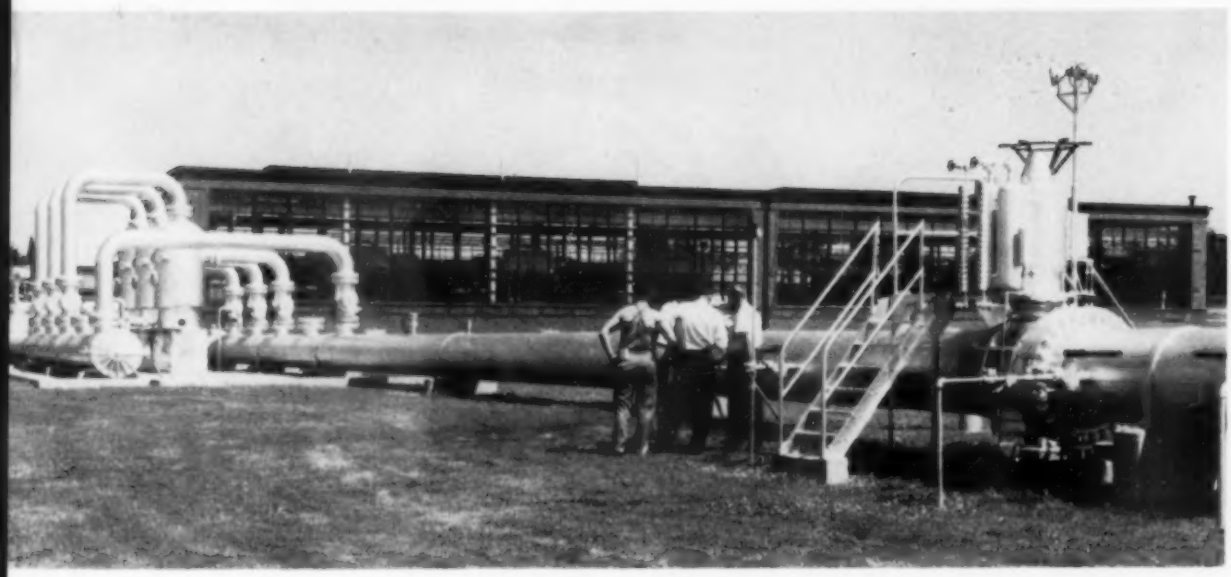
Motor starting performance . . . The motor delivers full-load torque of 87,500 ft.-lb., and this is the approximate torque both at starting and at 95 per cent speed, with full voltage on the stator windings. The motor is started across-the-line by closing its breaker, connecting it to the 4160-volt station bus in the outdoor switchgear at the substation. The starting current at full voltage is 8,000 amp., bu the motor voltage and resultant current drawn are somewhat reduced by reactance drop in the 16,000-kva. transformer supplying the station. The motor-gear-compressor system is a relatively high inertia load, having WK^2 of about 170,000 lb.-ft.^{2} referred to the motor shaft. This means about 43,000 hp.-seconds of energy is delivered to accelerate the drive. An equivalent heating effect occurs in the motor rotor, requiring special construction of the starting winding. This winding consists of metallic bars embedded in the pole faces of the rotor and brazed to segmental end rings to form a cage winding similar to that of an induction motor. The end-winding segments, instead of being bolted together between poles as usual, are joined by flexible connectors made of thin copper strips silver plated to maintain surface conductivity. The drive accelerates in about 8 seconds, after which the control equipment applies excitation automatically at the correct speed and most favorable rotor position for smooth synchronization. When the motor is running synchronized its starting winding is inoperative, hence it is designed for maximum starting effectiveness without impairing the running efficiency of the motor.

Speed-increasing gear unit . . . The 17,250-hp. rating of this gear is based on the driving-motor rating of 15,000 hp. with a 1.15 service factor. The ratio 7.229 provides an output speed of 6,506 r.p.m. with the 900-r.p.m. motor speed. As mentioned in discussing the motor, the high stored energy in the rotating parts of the system makes a difficult starting condition, so the gear was designed for minimum WK^2.

The problem became one of keeping the low-speed gear diameter to a minimum, since the WK^2 of this gear represents by far the major portion of the total WK^2 of the gear unit. To reduce the low-speed gear diameter meant attempting to reduce center distance. In order to maintain sufficient horsepower capacity, this in turn meant widening the face. Widening the face, of course, increases the bearing span, and in the high-speed shaft this presents a problem of deflection.

These considerations led to a final design calling for a gear unit having at 42-in. center distance and 34-in. face, with the gearing being heat treated. The heat treatment, of course, allowed a higher rating on the unit than would have been allowed on a similar unit with nonheat treated gearing.

A major unusual step was taken in the design by using three bearings for the high-speed shaft. This reduced the high-speed bearing spans and thereby eliminated the problem of the high-speed deflection. The unit as built has a WK^2 of approximately 68,000-lb.-ft.^{2} including the low-speed coupling. The low-speed gear is fabricated with a froged-steel alloy rim and a forged-steel hub, while the high-speed pinion is of forged steel, the pinion being integral with the shaft.



2. GLADEVILLE STATION . . .

"Most Advanced Multiunit Electric Station"

THIS STATION, like three others on the 30-in. main line, has 15,000 hp. in six 2,500-hp. electric centrifugal units. Originally three units were installed. When the station was expanded, three others were added.

The station incorporates many Texas Eastern design innovations. For example, it has:

- The first use of air-to-oil coolers in the lube and seal-oil system. Emergency seal-oil tanks in newer units are supported directly from and above the compressor case. This cooling method eliminates the water problem.
- Forced-draft ventilated motors, eliminating the need for a fire wall.

COSTS, MANPOWER

Station cost initially	$1,593,765
Expansion cost	933,732
Total	$2,527,497
Initial cost per horsepower	$215.50
Expansion cost per horsepower	$124.50
Average cost per horsepower	$168.50

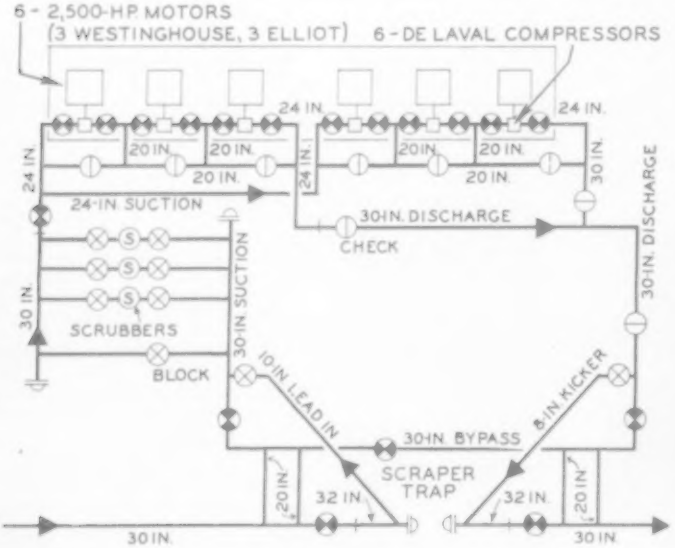
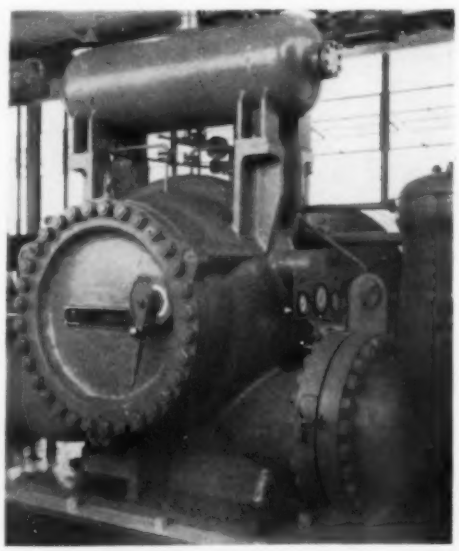
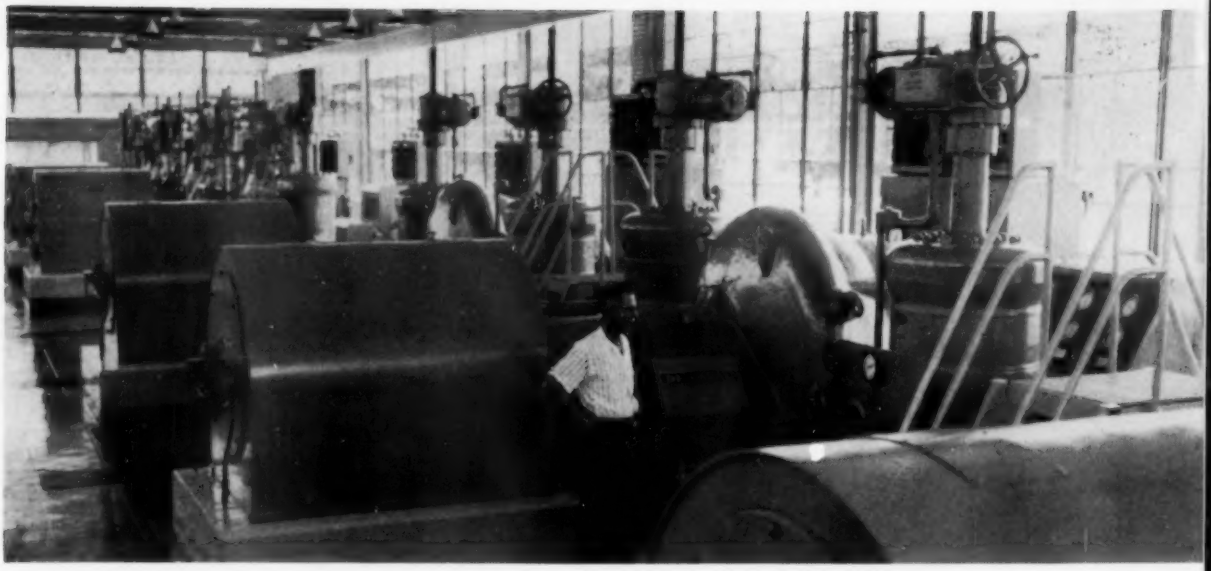


DIAGRAM of piping for six-unit electric station.



SINGLE-STAGE compressors in six-unit station.



THE 2,500-HP. induction motors are directly connected to centrifugal compressors. Each unit has console containing auxiliary equipment seen near the window. W. E. Worley, superintendent of compressor stations, is in foreground.

Station personnel	1 chief operator
	4 operators—1 per 8-hour shift
	1 operator oiler
	3 oilers
	1 relief oiler
	1 mechanic's helper
	1 station electrician
	1 maintenance man
Total	13

Significance

The most advanced design for electric-driven multiunit centrifugal stations is to be seen in four similar stations exemplified by the one at Gladeville, Tenn.

The six units are in two banks of three each operated in series. The two banks are operated together in parallel. Adjustment for differences in pressure between the two banks is achieved by changing the head, without throttling, through manipulation of a small lever for controlling internal vanes directing gas to the impeller of the De Laval centrifugal compressor. These vanes were first installed at the Gladeville-type stations.

The fact that the six-unit Gladeville station handles the same volume through the same diameter line as the Mount Pleasant invites comparison between the single unit and the multiunit 15,000-hp. stations.

While the performance efficiency of Gladeville is near that of Mount Pleasant, the six-unit type of installation at Gladeville results in larger installation investment. Mount Pleasant cost is 68 per cent of Gladeville. The more complex piping of Gladeville necessarily produces more loss in station efficiency than the simpler piping for the single unit at Mount Pleasant.

Though highly efficient, the Gladeville-type station is being superseded in future planning by the more economical later single-unit Mount Pleasant type.

STATION EQUIPMENT

Prime movers, 6 ..... Westinghouse Electric Co. Elliott Co.

2,500-hp. squirrel-cage induction motor, 2 pole, 3 phase, 60 cycle, 3,600 r.p.m., 4,160 volts, 290 amp., with base-ventilated enclosure.

Gas compressors ..... De Laval Steam Turbine Co.

2,500-hp. single-stage centrifugal compressor units have single suction, overhung 35-in. diameter impellers, 24-in. flanges and adjustible inlet guide vanes. Case has vertical cover plate for accessibility to repairs.

Compressor Operating Characteristics
(Two parallel groups of three units in series—split suction)

	1st stage each group	2nd stage each group	3rd stage each group
Suction pressure, psia.	649	739.5	841
Discharge pressure, psia.	739.5	841	956
Suction temperature, °F.	65	84.7	104.6
Discharge temperature, °F.	84.7	104.6	125
Inlet, cu. ft./min.	4,880	4,457	4,060
Capacity, M.M.s.c.f.d.	330	330	330
Head developed, ft.-lb./lb.	5,600	5,800	5,950
Shaft speed, r.p.m.	3,750	3,570	3,570
Rated hp.	2,500	2,500	2,500
Present impeller diam., in.	35	35	35
Rotation, from driver's end	Clockwise	Clockwise	Clockwise
Case hydrostatic test pressure, psi.	1,500	1,500	1,500

CONSOLE with auxiliary equipment serving compressor unit (foreground). Beyond is oil-to-air coolers—cooling from 165° to 145° F.

3. ATHENS STATION . . .

"Largest Gas Turbines In Gas-Transmission Service"

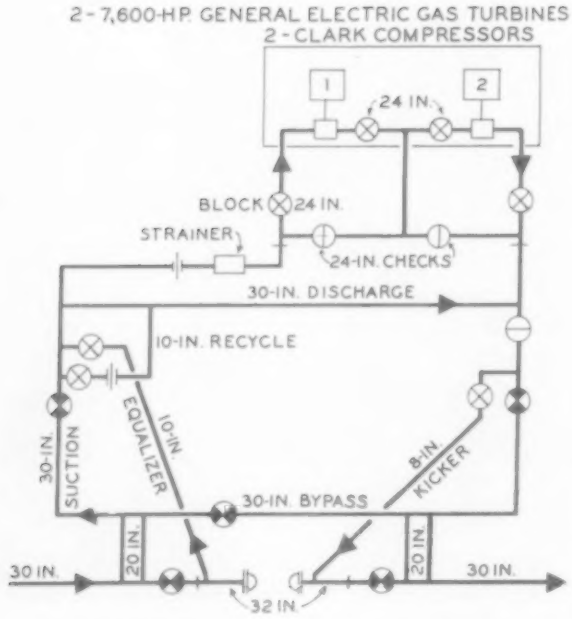


DIAGRAM of piping for two-unit gas-turbine station.

THIS STATION, like one other on the main line from Kosciusko to Oakford, is powered by two 7,600-hp. gas turbines driving two centrifugal compressors in series. They are the largest gas turbines in natural-gas-transmission service.

Significant advances in the design of gas-turbine stations observed are as follows:

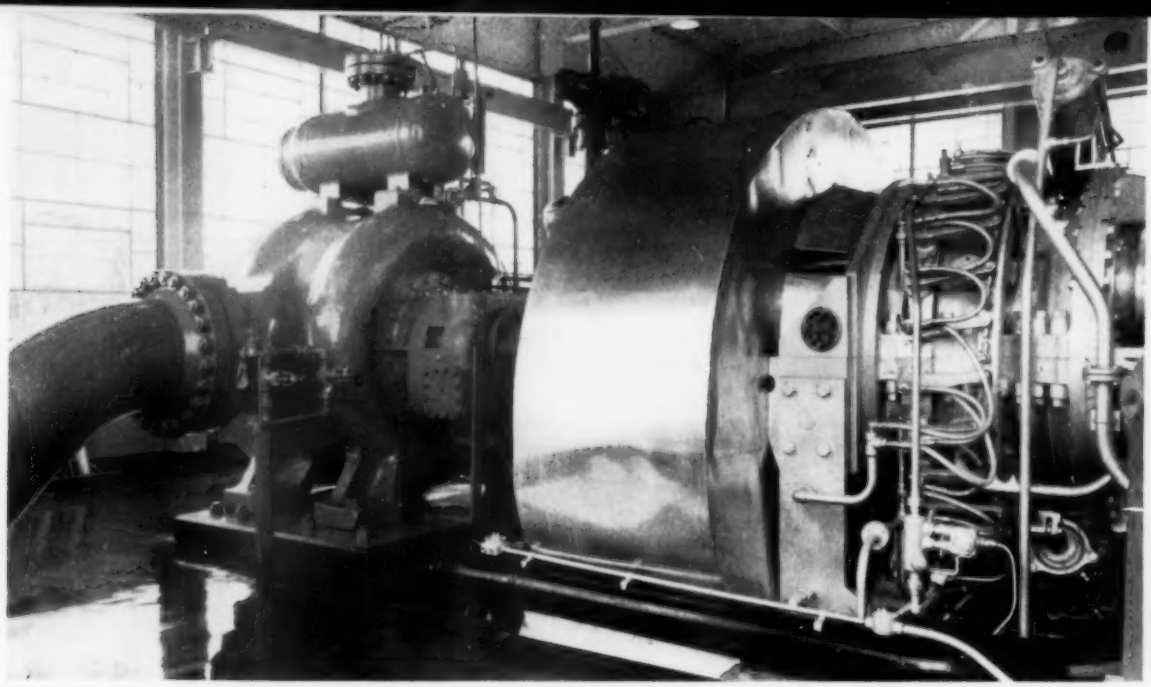
- The exhaust on these turbines was turned downward and the regenerators were set at one side to give maximum access and ready maintenance to the horizontally split casing machines. This arrangement of the duct work, together with mounting the turbines on fabricated steel bases, enabled the operating floor to be as close to the ground as possible. It also enabled the concrete foundations beneath the turbines to be simplified.
- An important design feature is the "straight-through" gas piping between the compressors. The straight-through piping is more efficient and less costly than expansion-loop connections between compressors.
- Construction cost is reduced by having gas-turbine equipment mounted at the factory on steel bases, on which it is transported and installed at the station.

COSTS, MANPOWER

Station cost		$3,026,400.00
Cost per horsepower		199.11
Station personnel	1 chief operator	
	4 operators—1 per 8-hour shift	
	1 operator oiler	
	3 oilers	
	1 mechanic's helper	
	1 maintenance man	
Total	11	

Significance

The versatility of the gas turbine centrifugal is exemplified at the Athens, Ohio, station where it functions on the 30-in. line transmitting gas to the Oakford storage field. Concentration of power in two of the largest size gas turbine units of 7,600 hp. each contributes to low station investment of $199.00 per horsepower which is much below that for a reciprocating station ($250 to $300 per horsepower). However, fuel consumption for both this type of



ONE OF TWO 7,600-HP. gas turbines driving centrifugal compressor at station transmitting to storage. Turbine equipment is factory mounted on steel base to reduce construction cost.

gas turbine and reciprocating units would be nearly the same—9 to 10 cu. ft. per horsepower. The high efficiency of these General Electric gas turbines is 28½ per cent. Such a station fits the needs where electric power is unavailable at satisfactory price and in sufficient quantity. Furthermore, concentration of power in big units gives simplicity of operation, which reduces the attention needed from operating personnel.

STATION EQUIPMENT

Prime movers ..... General Electric Co.
Two 7,600-hp. gas turbines of two-shaft open-cycle with regenerators. Each turbine is provided with a regenerator, pipe, and duct connections to the regenerator, and air intake silencer, a gas-expansion starting turbine, a lubricating system, speed governing equipment, sequential starting controls, safety shutdown, and alarm equipment.

Gas compressor ..... Clark Brothers Co.
Two 7,600-hp. single-stage, single-suction, centrifugal-type compressors with 32.6-in.-diameter impellers. Unit has 24-in. flanges and vertical cover plate for repair accessibility and fixed-angle guide vanes.

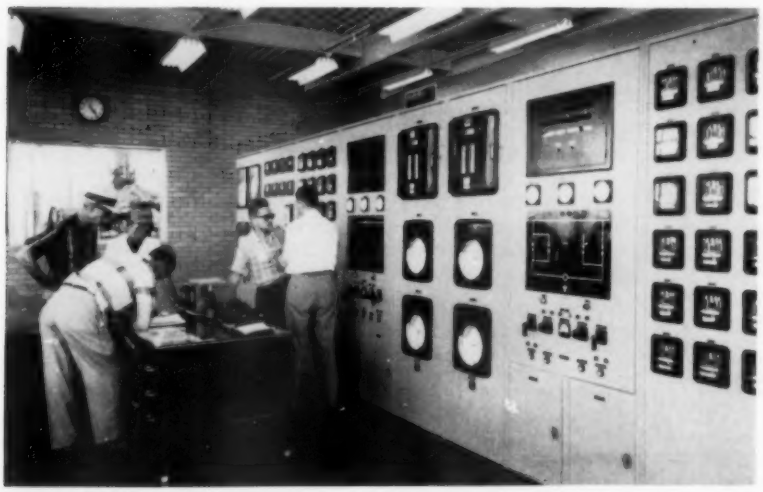
Compressor Operating Characteristics

Rotation, from driver end	Counter clockwise
Suction pressure, psia.	637
Suction temperature, °F.	65
Discharge pressure, psia.	955
Station compression ratio	1.50
Discharge temperature, °F.	126
Rated volume, cu. ft./min.	10,120
or, M.M.s.c.f.d.	672
Rated head, ft.-lb./lb.	17,960
Rated r.p.m.	5,400
Rated hp.	7,600

Station surge control . . . A 10-in. recycle line is situated to circulate the gas flow from the station discharge line into the station suction line. This recycle line is equipped with a 10-in. gate valve and EIM electrically controlled operator which is sequentially integrated in the station control system to regulate the station load at some predetermined rate and to relieve the compressor surges during startup and shut down by controlling the rate of flow through the compressors.

Emergency shutdown system . . . Six pushbutton stations and two manually operated valve stations actuate the system to close the station suction and discharge plug valves and open the single station blowoff valve simultaneously with initiating the turbine sequential shutdown system to cut off the turbine driver. System is designed to fail safe.

Automatic shutdown system . . . Emergency system is "automatically" activated to complete the emergency shutdown sequence by complete line failure or other type of blowout in either the main line, station suction, or discharge line. Controls are located by the station suction valve.



CONTROL ROOM with instrument board for two gas turbine centrifugal compressor units. Each unit has illuminated diagram. One of the units is seen through window in background.

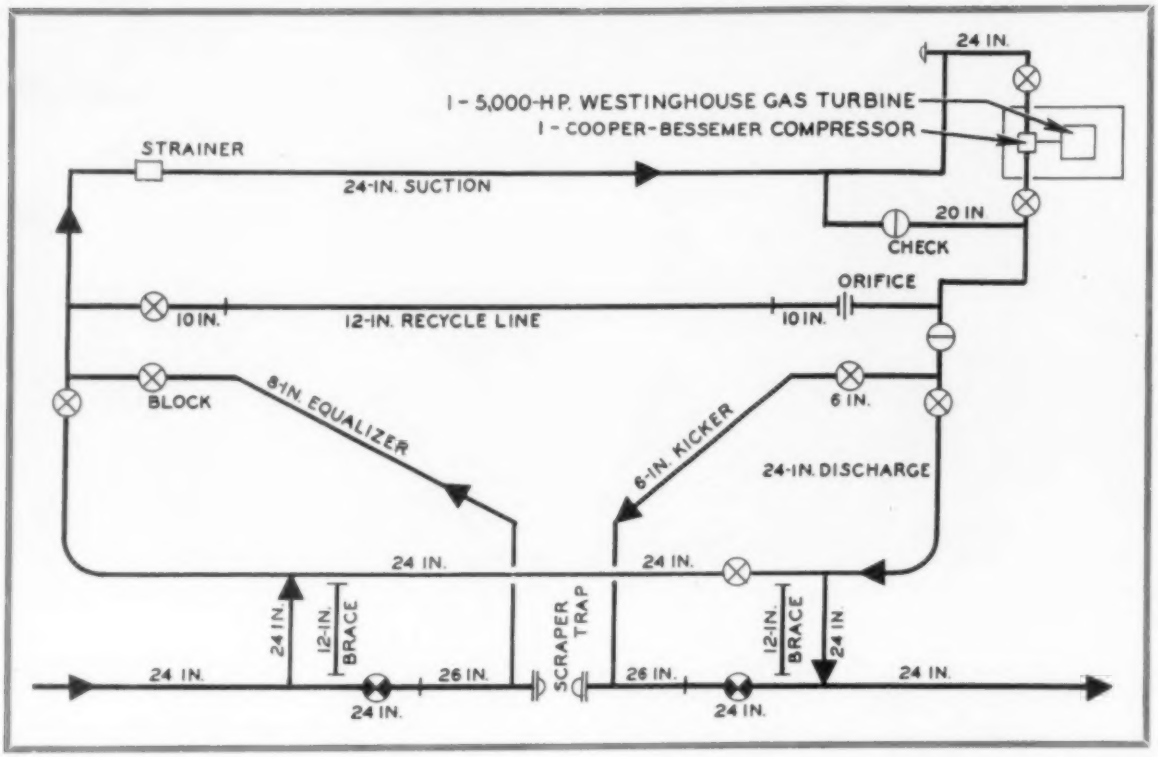


DIAGRAM OF STATION PIPING showing provisions for facilitating operation of scraper traps. By routine on-stream running of scrapers high pipeline efficiency is maintained.

4. GRANTVILLE STATION . . .

"Compression-Ratio Fluctuations Easily Handled"

THIS STATION, started up in November 1956, has a 5,000-hp. gas turbine driving single-stage centrifugal compressor. Another 5,000-hp. turbine is being installed. This station is identical to the Perulack, Pa., station also located on the 24-in. main line from Oakford storage to Lambertville, N. J.

Air-to-oil lube-oil cooling eliminates the need for water service for the gas turbines. The station was built with a view to expansion without interruption of service on the line.

COSTS, MANPOWER

Station cost	$1,295,248.00
Cost per horsepower	259.05

Station personnel	1 chief operator
	4 operators—1 per 8-hour shift
	1 relief operator
	1 mechanic's helper
	1 maintenance man
Total	8

Significance

The gas-turbine centrifugal unit at the Grantville station operates where it has the greatest competitive advantage over electric centrifugals and reciprocating units. It is a natural for handling winter peak loads on the line from Oakford storage to connections with eastern metropolitan markets:

- In cold winter weather when the gas demand is greatest, the nominally rated 5,000-hp. turbine will develop 6,250 hp.
- Fluctuations of operating compression ratios are readily handled because of the gas turbine's flexibility.
- In summer the station may be completely shut down with the crew assigned to other duties.

The superiority of the gas-turbine centrifugal for storage-to-market service is indicated by Texas Eastern's program for using only gas turbines at the downstream stations on the Oakford, Pa.-Lambertville, N. J., line. The program for existing and future Westinghouse 5,000-hp. units in Pennsylvania is as follows:

Existing units—2 (Grantville and Perulack).

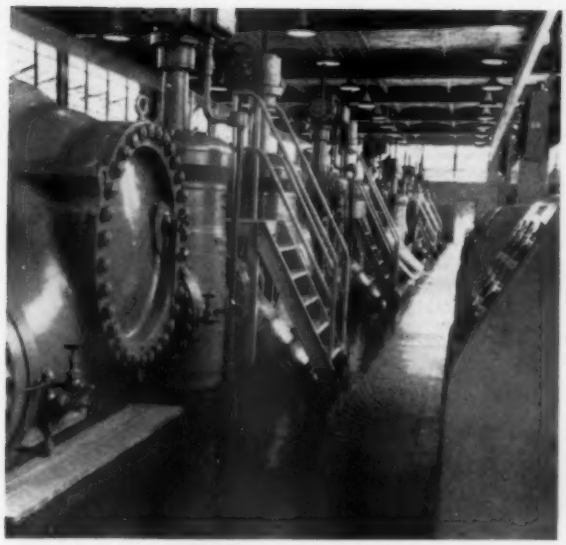
Future units under construction and planned—10 (2 Perulack, 2 Grantville, 3 Lilly, 3 Bechtelsville).

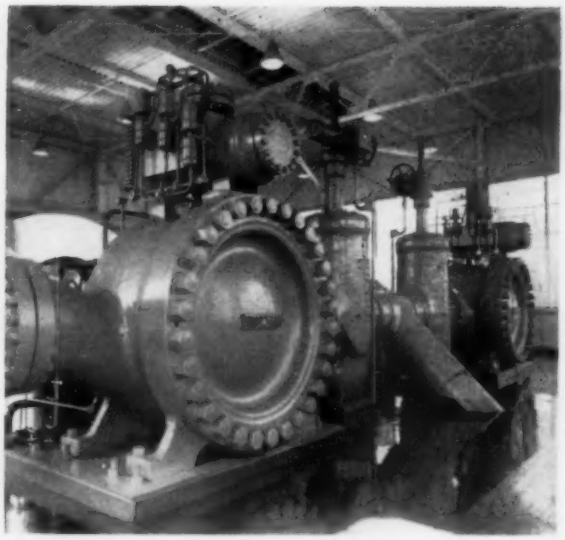
STATION EQUIPMENT

Prime mover . . . . . Westinghouse Electric Corp. 5,000-hp. gas turbine, of two-shaft, open-cycle, mechanical-drive unit with regenerator and variable-speed control.

Gas compressor . . . . . Cooper-Bessemer Corp. 5,000-hp. single-stage, single-suction, centrifugal-type compressor with overhung 33.6-in. diameter impeller. Unit has 24-in. flanges and vertical cover plate for repair accessibility and fixed-angle inlet guide vanes.

Station surge control . . . A 10-in. recycle line is situated to circulate the gas flow from the station discharge line into the station suction line.





Electric drive . . . Gas-turbine powered

. . . and now . . . here's the story behind

Texas Eastern's Development of Centrifugal-Compressor Stations

It pioneered their use 10 years ago and is their largest user today

TEXAS EASTERN and the centrifugal compressor have grown up together in the natural-gas-transmission industry. Texas Eastern was organized 10 years ago to convert the Big Inch and Little Big Inch crude and products lines to natural gas. The centrifugal compressor was born out of the necessity for Texas Eastern to make maximum use of the facilities it had purchased with the war emergency pipelines from Texas to the East Coast.

The company already had power facilities and motors in the stations on the oil lines. If these were to be salvaged, a centrifugal-type compressor was the only answer. Texas Eastern did develop the original high-pressure centrifugal for a gas line. Units were designed, built, and installed within a few months.

This meant that Texas Eastern could start operating earlier, reach increased throughput goals faster, and with lower investment costs. All that was necessary was to move the oil pumps out and move the compressors in. This was done successfully with the result that a new gas-transmission technique was born and its originator got a running start in the business.

In the 10 years since their development Texas Eastern has recognized the limitations of centrifugals while learning to exploit their advantages. But in the meantime, the conventional reciprocating compressors have also played an important role in growth of the system through their ability to perform under conditions of varying loads. The total system horsepower is comprised of 41 per cent reciprocators and 59 per cent centrifugals (34 per cent have electric drives and 25 per cent gas turbines).

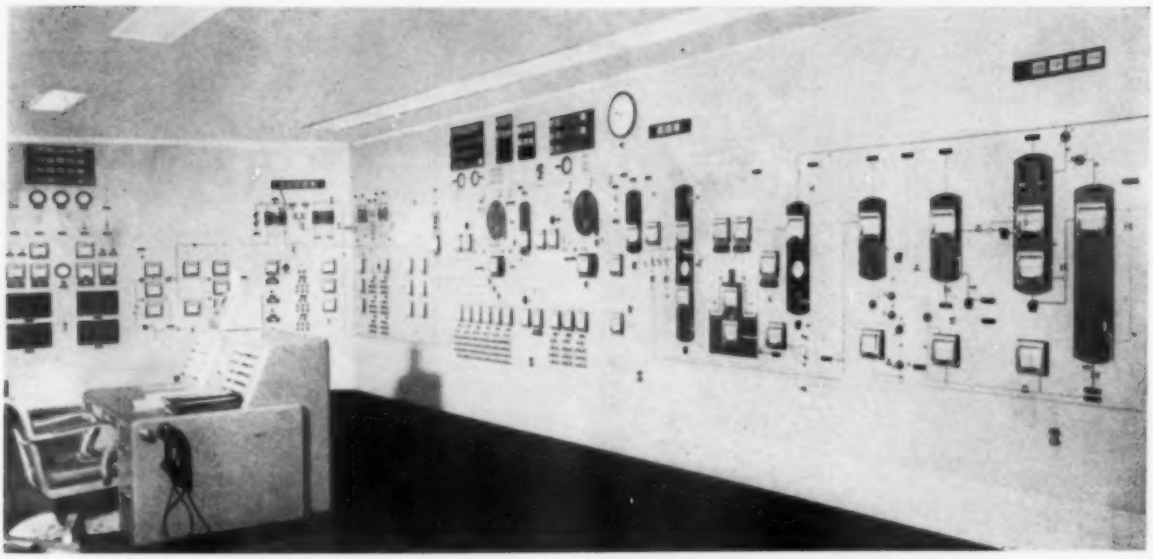
No other company has gone to electric-centrifugal compressors to any extent. Texas Eastern, however, has turned what in the beginning was a major problem into an asset of its system. When the Kosciusko-to-Oakland storage line was built in 1952, centrifugals also were installed on half the stations. The technique has been improved considerably since 1957.

The development is exemplified in three stations on the Kosciusko line which are powered by a single 15,000-hp. synchronous electric motor. Texas Eastern worked for several years to develop a station with this large concentration of power in a single unit. There is nothing else like it in gas pipelining. The magnitude of Texas Eastern's use of electric centrifugals is indicated by the fact that it is one of the largest buyers of electric power in the U. S.

Gus turbines are playing an increasingly important role in the Texas Eastern picture. The company is currently one of the largest buyers of this prime mover, which works well both at base-load stations and where varying loads place a premium on flexibility.

Among this year's installations of gas turbines for the gas-pipeline industry, those for Texas Eastern are the largest, totaling 95,200 hp. in 16 units. These, added to the existing 40,400 hp. at 14 stations, will bring total installed gas-turbine horsepower for Texas Eastern in 1957 up to 136,000.

Texas Eastern, at the end of this year, will have delivery capacity of 1,811,520,000 cu. ft. daily, 540,270 compressor horsepower in 54 stations, and 5,900 miles of natural-gas pipeline from Mexico to New England.



NEW GRAPHIC control panel installed for M.E.K. dewaxing plant of Esso Standard Oil Co. at Bayonne, N. J. Panel is constructed in form of a wide-base inverted U. Long graphic section in center contains control stations for major process equipment. Flanking nongraphic sections are for instruments on auxiliary process equipment and utilities. Fig. 1.

How Esso Modernized Controls

. . . for M.E.K. dewaxing plant

By L. Anderson and Robert Silva

AN AUTOMATIC system to control "hot washing" of filters and depressurizing of scraped-surface heat exchangers was installed at the M.E.K. dewaxing plant of Esso Standard Oil Co., Bayonne, N. J., during the plant turnaround in September 1956.

Other plant improvements involving control systems of interest included the installation of an additional ammonia compressor, additional rotary vacuum filters, and improvements in pumps and motors. Objectives were: to increase the quality of the wax product, increase plant throughput, and make more efficient use of operating personnel.

Since the existing control system required extensive updating to realize these objectives, a cooperative program was undertaken among the engineering departments of the refinery, Esso Research & Engineering Co. and the major instrument supplier, Foxboro Co.

1. Centralized Control Panel

Serving as the nerve center of the modernized plant is a new graphic control panel, 59 ft. long, shown in Fig. 1. For better supervision of plant operations, all measurement and control intelligence and all warning signals are presented on this panel. Centralized, too, are all the remote operating stations. A simplified graphic flow diagram of the unit serves as a memory aid for the operators and supervisors, with points of measurement, location of valves, and instrument interconnections shown on the panel.

Graphic and nongraphic sections . . . Constructed in the form of a wide-base inverted U, the panel consists of a long graphic section containing the compact control stations for major process equipment, and flanking nongraphic sections for instruments used on auxiliary process equipment and utilities. In the center of the control room facing the main panel is the operator's console desk with built-in monitor for selected plant temperatures.

Transmission distances . . . With the control room located along the unit's eastern battery limit, transmission distances vary from 75 to 350 ft., depending on the position of process equipment in relation to the control room. All measurements are remotely transmitted. With the exception of temperatures, which are measured electronically from thermocouples, pneumatic transmission is used throughout.

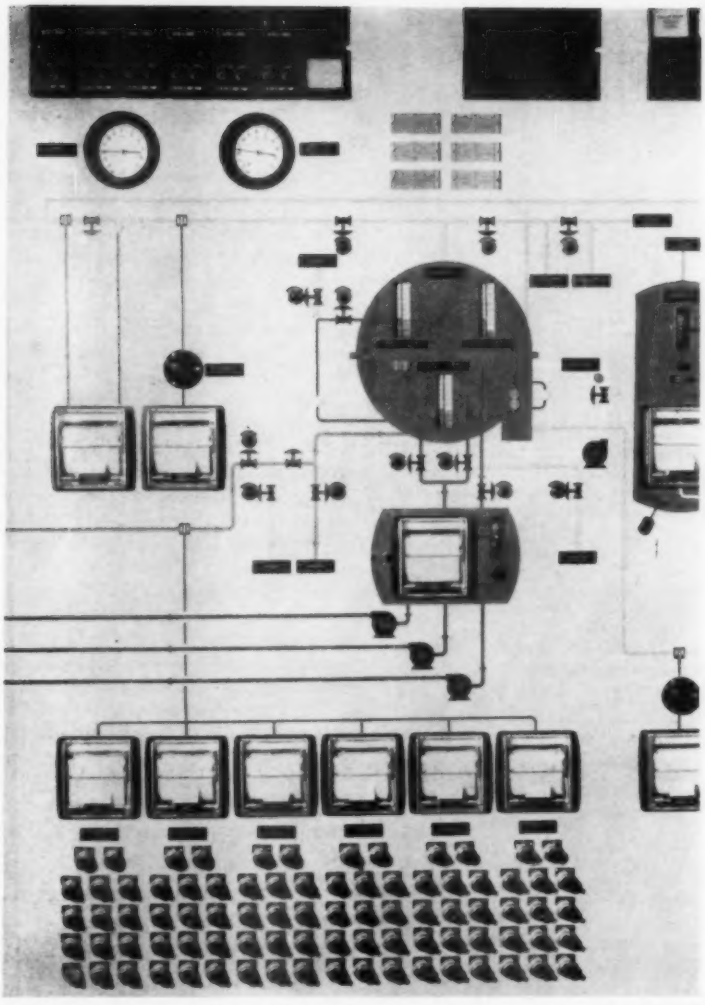
2. Filter Wash Sequence System

A rotary vacuum filter requires "hot washing" when the feed rate to the filter drops below a minimum, indicating a dirty filter cloth. In continuous washing of the cloth, the feed, vacuum, and cold solvent valves are first closed, followed by opening of the hot solvent inlet valves and drain valves. After the required period of hot-solvent wash, the hot-solvent and drain valves are closed and the feed, cold solvent, and drain valves are reopened returning the filter to service.

Automatic washing . . . With the installation of the new control equipment, filter washing has become completely automatic. When desired, all steps in the wash cycle may be started

L. Anderson is with Esso Standard Oil Co. at Bayonne, N. J. Robert Silva is with Foxboro Co. at Foxboro, Mass.

REFINING



FILTER-WASH control system. Progress of the filter-wash cycle may be followed on the board. Wash cycle may be operated fully automatic or semiautomatic, at the operator's option. Fig. 2.

and carried out remotely from the central control panel.

The filter wash control system, Fig. 2, provides:

1. Fully automatic or semiautomatic initiation and operation of preset filter washing cycle at operator's option.

2. Visual indication on the panel of cycle progress and position of sequenced valves.

3. Records of trends in operational guide variables.

4. Interlocks to initiate corrective action or inactive automatic cycle equipment when selected variables exceed limits or when situations requiring judgment arise.

5. Remote manual positioning of all sequenced valves, by selection, from the control panel.

6. Alarms to warn operators of abnormal conditions.

Electropneumatic actuators . . . Filter feed rate is the variable which "triggers" automatic operation. When feed rate to a filter falls below an adjustable preset value, a battery of timers is started. Relays connect the time-controlled contacts of these timers to electropneumatic actuators for the filter control valves. To assure maximum flexibility in washing operations, each set of valves common to a step in the washing sequence is controlled by two separate timers, one for opening and the other for closing.

Selector switch . . . If low-feed-rate trigger signals are received from two or more filters while a washing cycle is in progress, an alarm sounds and the automatic cycle equipment deactivates at the conclusion of that cycle. Alerted by the alarm, the plant operator manually selects the next filter to be washed. One selector switch is provided for each of the nine filters. By turning the switch for the appropriate filter to manual and depressing a push button, the operator initiates a filter wash on the same time cycle provided by automatic triggering.

Interlocks . . . These prevent any one filter from being washed automatically twice in succession. If a double wash is attempted, an alarm sounds to warn the operator that some corrective action should be taken regarding that particular filter. Additional interlocks prevent automatic washing of filter if its feed rate falls rapidly to almost zero flow. Such a drop in feed flow indicates an abnormal drop in filtering rate caused by factors other than normal cloth fouling. Interlocks also prevent the start of a washing cycle in the event of high level in the wash receiver drum.

There are lights on the control panel to show what filter is being washed and to indicate the position of the 12 sequenced valves for that filter.

For remote manual positioning, the panel contains a separate auto-close-open or auto-open-close switch for each of the 102 valves.

3. Depressuring Sequence System for Chillers and Exchangers

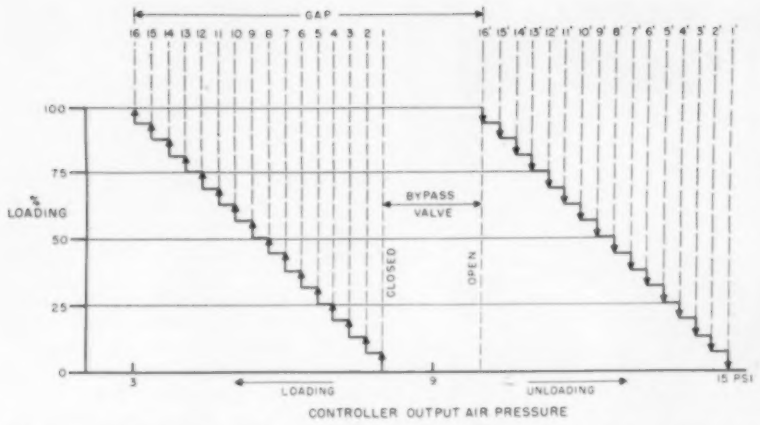
Sequence systems which are functionally similar to that described for the filters control depressurizing of the scraped-surface double-pipe chillers and exchangers. Here, the trigger for fully automatic operation is the differential pressure across the chillers and exchangers on the wax slurry line. Semiautomatic operation of an individual unit is obtained by means of a push button. In addition, all sequenced valves may be remotely positioned from the control panel.

System interlocks prevent more than one double-pipe unit from being depressurized at any one time, prevent a repeat cycle, and prevent any wash cycle when the receiver drum is at a high level.

4. Compressor Loading Control

Four reciprocating-type ammonia compressors are furnished with clearance pockets and cylinder unloaders which are used to adjust the effective capacity of the compressors to the load conditions.

Sequence operator . . . In this installation, the loading controller uses suction header pressure as a measure of the unbalance between process demand and compressor loading. As



AMMONIA COMPRESSORS are provided with loading devices and these latter are closed or opened according to sequence shown here. Loading controller uses suction header pressure as measure of unbalance between process demand and compressor loading. Decreasing controller output closes the 16 unloading devices, increasing output opens them. Fig. 3.

suction pressure tends to increase, the controller positions a sequence operator to close the loading devices in accordance with an established sequence. The sequence is diagramed in Fig. 3. Decreasing output closes the 16 devices at operating points 1, 2, 3, 4, etc. Increasing output opens them at 16′, 15′, 14′, 13′, etc. This is known as "gap action," the distance between 16 and 16′ being the "gap."

At each operating point a substantial change in loading is produced. When a loading device closes, the suction pressure reduces until loading and demand balance. This change in suction pressure must not cause the loading device just closed to open or cycling will result. Gap action prevents this.

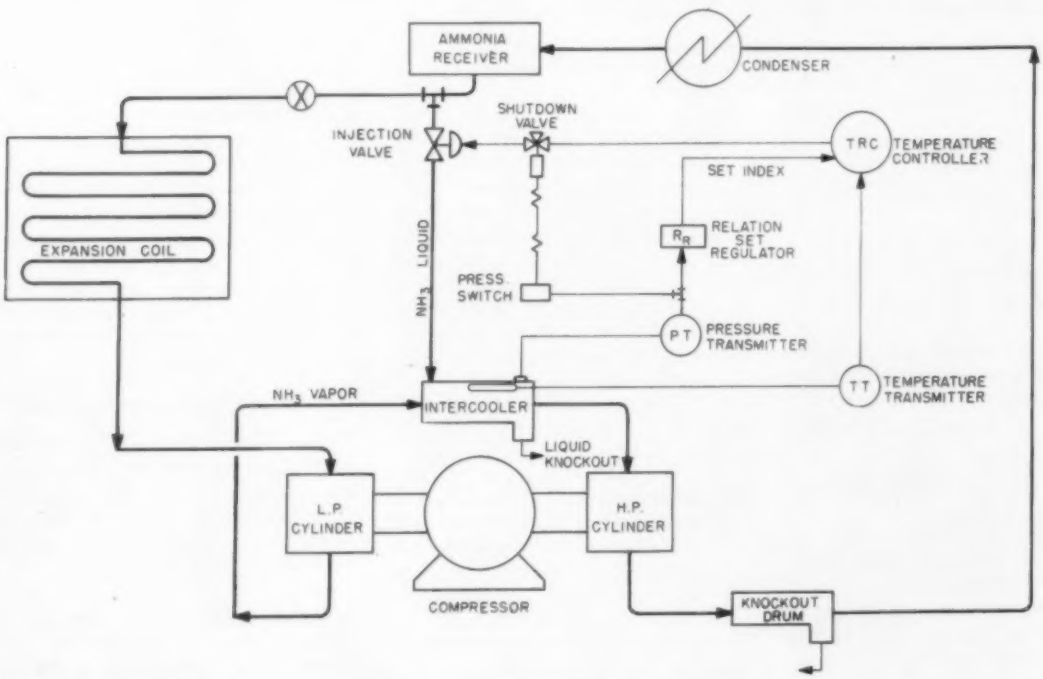
Bypass trim control . . . The loading controller, with proportional-plus-reset control action, holds suction pressure within close limits. To insure stability, a valve, bypassing discharge of compressors to suction, is throttled to "trim" the loading to meet the demand.

5. Compressor Intercooler Superheat Control

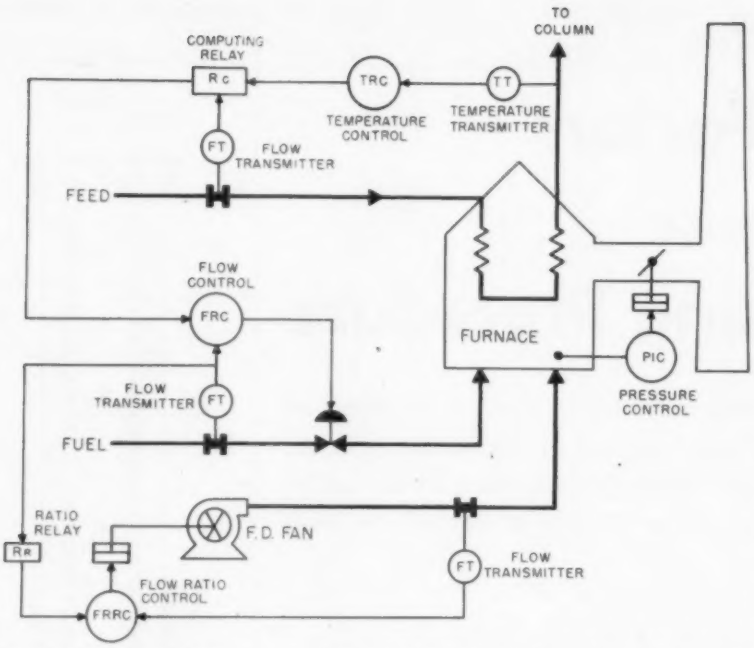
The temperature - pressure relation control system for the ammonia compressor intercooler shown in Fig. 4 precisely controls the temperature of the second-stage inlet vapor at any desired preset value of superheat. Liquid ammonia injected into the vapor discharged from the first stage serves as the cooling medium.

Ammonia-filled bulb . . . The control system features a temperature controller with the temperature control index set by a pressure transmitter through an air-and spring-loaded regulator. The vapor-pressure-type thermal system for the temperature transmitter is unique in that ammonia is used as the filling material instead of the conventional filling. The use of ammonia gives a reading directly in terms of equivalent ammonia pressure on a pressure scale.

Equivalent ammonia pressure . . . The spring setting on the air-and-spring-loaded regulator is adjusted so that the temperature control index will at



AMMONIA COMPRESSOR intercooler superheat control. This controls the temperature of the second stage inlet vapor at any desired preset value of superheat. Fig. 4.

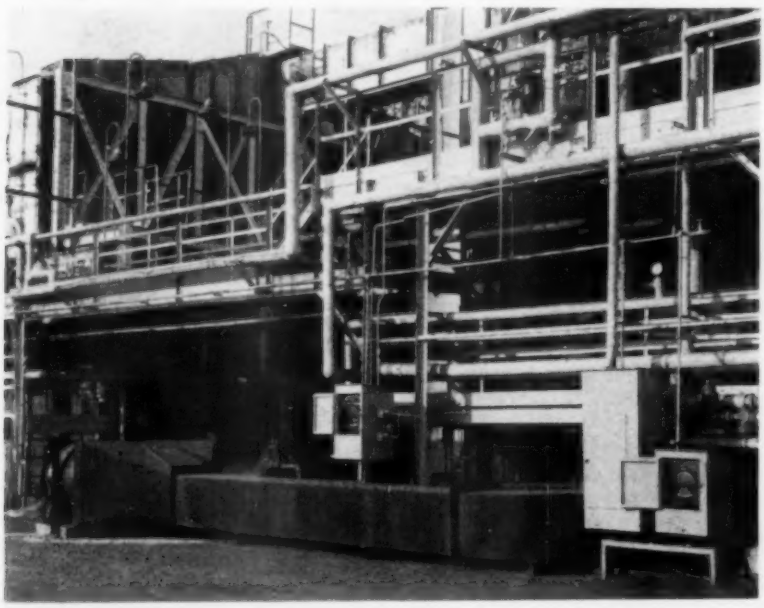


COMBUSTION CONTROL system. Ratio of fuel to feed is automatically changed by temperature controller when a load change occurs and coil outlet temperature begins to deviate. When fuel input changes the fuel-air ratio controller changes combustion air output to furnace. Fig. 5.

all times be a few degrees above the pressure reading. Consequently, maintaining a fixed differential between the pressure reading and the temperature index insures a definite amount of superheat anywhere on the scale.

Prevent intercooler flooding . . . Further provision is made to insure that the ammonia-injection valve will be closed during periods of compressor shutdown. Otherwise, the relation feature of the controller would result in flooding of the intercooler with liquid ammonia. On shutdown, the temperature value drops to ambient temperature and the pressure value drops to zero. However, the temperature-control index only drops to the scale value determined by the "gap" imposed by the spring adjustment of the regulator. The controller, in attempting to keep the temperature pen and index aligned, would operate to keep the injection valve open.

Pressure switch . . . The required shutdown action is provided by a pressure switch in the signal line from the pressure transmitter which trips an electric solenoid valve in the instrument output air line to the injection control valve. The solenoid valve vents the pressure on the diaphragm of the air-to-open control valve, thereby insuring its closure.



FURNACE pressure controller, in the system shown in Fig. 5, is field-mounted for maximum speed of response. Output of controller positions damper in outlet breeching. Fig. 6.

6. Combustion Control for Solvent-Recovery Furnace

The addition of a forced-draft system and combustion controls increased the design capacity of the solvent recovery furnace by 11 per cent and increased the efficiency throughout the entire firing range.

Optimum combustion efficiency and precise control of coil outlet temperature were established by the integrated combustion control system shown in Fig. 5.

The furnace pressure controller shown in Fig. 6 is field mounted for maximum speed of response. The output of the controller positions a damper in the outlet breeching.

7. Operating Experience

The modernized instrument system has achieved the following results:

1. Automatic sequencing of filter wash and depressurizing cycles has increased plant throughput and improved product quality.

2. Centralization of remote operating stations for sequenced valves permits the operators to correct process deviations before they become major upsets.

3. Integrated combustion control for the solvent recovery furnace has reduced fuel consumption and has improved efficiency of the solvent-recovery system.

4. Loading and intercooler controls for the ammonia compressor have produced more efficient, automatic operation of these units.

5. The consolidated control panel has definite value, particularly during emergencies, and the graphic treatment has proved especially useful in training new personnel.

Acknowledgment

The authors wish to acknowledge the contributions of J. E. Borner, J. C. Broman, W. J. Cesarz, and A. M. Foster, of Esso Standard Oil Co. and D. F. Franks and R. Guimond, of Foxboro Co.

Here are the Down-Hole Factors that influence Casing-Landing Procedure

Casing should be landed not only to prevent buckling as cement sets but to prevent buckling or excessive wellhead loads in later operations. Equations presented here provide the means for selecting optimum pickup or slackoff for most down-hole conditions.

By W. R. Cox

CASING-LANDING methods should be based on consideration of both buckling and wellhead loads on the string. Location of freeze point is important to choice of method. High temporary freeze points may preclude landing casing with adequate pickup to prevent buckling under certain conditions.

Large changes in wellhead load may occur after the casing is hung. These are caused by temperature, pressure, and fluid-weight variations subsequent to landing casing.

This article shows how the various down-hole factors influence casing-landing procedure.

Study of methods . . . In March 1955 the A.P.I. Southwestern District Study Committee on Casing Landing Practices reported[3] on 3,700 wells in which casings were landed by one of four methods: as cemented, in tension at the freeze point, neutral at the freeze point, or in compression at the freeze point. In view of the wide difference in methods of landing casing under similar conditions, the study committee recommended a landing practice which they believed ". . . should afford the greatest amount of protection and service from A.P.I. casing in a very high percentage of wells drilled in the southwestern United States."

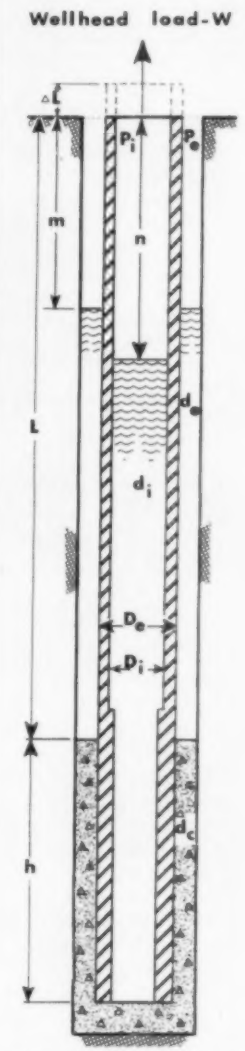
The study committee recommended that casing be landed as cemented in all wells where mud weights do not exceed 12.5 lb. per gal., where standard design factors are used, and where the wellhead equipment and outer casing strings are of sufficient strength to withstand the landing loads. The term, as cemented, means that the casing is landed in approximately the same position in which it was hanging when the cement set. The only movement of the casing would be that necessary to transfer the weight to the casing hanger.

Author is with Shell Oil Co., Corpus Christi, Tex. Paper presented at the 1957 spring meeting of the Southern District, A.P.I. Division of Production, Shreveport, La., under the original title, "Key Factors Affecting Landing of Casing."

Prevent buckling . . . In wells where design factors are low, where extreme pressures are encountered, where excessive mud weights are necessary or where other unusual circumstances exist, the study committee recommended the landing practice be based on theoretical considerations developed by Lubinski.[1] Lubinski's theoretical analysis yields means for determining if casing is buckled or has a tendency to buckle under down-the-hole conditions. By proper selection of landing procedure Lubinski showed that buckling could be prevented.

Prevent tensile failure . . . A landing procedure based only on buckling considerations may result in undesirable axial loading. For example, if the hanging method calls for casing to be picked up a considerable amount from the as-cemented position, then large temperature drops in the free casing subsequent to hanging could produce additional tensile loading sufficient to cause tensile failure. In addition to temperature, pressure and fluid-weight changes influence the hanging load and these also should be considered before selecting a hanging procedure.

The equations in Table 1 provide convenient means for calculating landing loads that preclude buckling and for evaluating the landing methods in terms of wellhead loads that may occur in the life of the well. The parameters in the equations are believed sufficient for consideration of most down-the-hole environments.



PARAMETERS for determining casing-landing procedure are shown above. They are defined in Table 1. Fig. 1.

Buckling Phenomenon

The phenomenon of buckling of oil-well pipe has received increased attention in the last 6 or 7 years. This is

TABLE 1—EQUATIONS FOR DETERMINING CASING-LANDING LOADS

Pickup to prevent buckling (lb.):

$$\Delta S > 59.8\ w'\ \Delta t - hw + 0.0408\ D_e^2\ [hd_e - 0.7\ L\ \Delta d_e - 7.7\ \Delta P_e + (d_e + \Delta d_e)\ (0.4\ m + 0.3\ m^2/L)] - 0.0408\ D_i^2\ [hd_i - 0.7\ L\ \Delta d_i - 7.7\ \Delta P_i + (d_i + \Delta d_i)\ (0.4\ n + 0.3\ n^2/L)]$$

or: $\Delta S > B_1 + B_2 + B_3 + B_4 + B_5 + B_6 + B_7 + B_8 + B_9 + B_{10}$ (1)

Wellhead load (lb):

$$W = \Delta S - 59.8\ w'\ \Delta t + w''\ (h + L) - 0.0408\ D_e^2\ [hd_e + L\ d_e + 0.3\ L\ \Delta d_e + 11.6\ (\Delta P_e + 1.67\ P_e) - (d_e + \Delta d_e)\ (0.6\ m - 0.3\ m^2/L)] + 0.0408\ D_i^2\ [hd_i + L\ d_i + 0.3\ L\ \Delta d_i + 11.6\ (\Delta P_i + 1.67\ P_i) - (d_i + \Delta d_i)\ (0.6\ n - 0.3\ n^2/L)]$$

or: $W = W_1 + W_2 + W_3 + W_4 + W_5 + W_6 + W_7 + W_8 + W_9 + W_{10} + W_{11} + W_{12}$ (2)

Equation 1	Equation 2	Factor	Definition of terms
	$W_1 = \Delta S$	Pickup when hanging casing.	ΔS—pickup when hanging casing, lb. (ΔL, in. $= 1.38\ \Delta S\ L\ 10^{-6}/w'$)
$B_1 = 59.8\ w'\ \Delta t$	$W_2 = 59.8\ w'\ \Delta t$	Temperature effect.	w'—weight of casing above cement top, lb./ft. Δt—average change in casing temperature above cement top after cement sets, °F.
$B_2 = -hw$		Weight if casing hanging below cement top.	h—distance from casing shoe to cement top, ft. w—weight of casing in cemented zone, lb./ft.
	$W_3 = w''\ (h + L)$	Weight of entire string in air.	w''—average weight of casing in string, lb./ft. L—distance from cement top to casing hanger, ft.
$B_3 = 0.0408\ D_e^2\ hd_c$	$W_4 = -0.0408\ D_e^2\ hd_c$	Cement slurry weight.	D_e—outside diameter of casing, in. d_c—cement slurry weight, lb./gal.
	$W_5 = -0.0408\ D_e^2\ hd_e$	Mud weight outside casing.	d_e—fluid weight outside casing when cement sets, lb./gal.
$B_4 = -0.0408\ D_i^2\ hd_i$	$W_6 = 0.0408\ D_i^2\ (h+L)\ d_i$	Mud weight inside casing.	D_i—inside diameter of casing, in. (for B_4, use i.d. below cement top; for W_6, use average i.d.; for other terms, use i.d. above cement top). d_i—fluid weight inside casing when cement sets, lb./gal.
$B_5 = 0.0286\ D_e^2\ L\ \Delta d_e$	$W_7 = -0.0122\ D_e^2\ L\ \Delta d_e$	Change in mud weight outside casing.	Δd_e—change in fluid weight outside casing after cement sets, lb./gal.
$B_6 = 0.0286\ D_i^2\ L\ \Delta d_i$	$W_8 = 0.0122\ D_i^2\ L\ \Delta d_i$	Change in mud weight inside casing.	Δd_i—change in fluid weight inside casing after cement sets, lb./gal.
$B_7 = 0.314\ D_e^2\ \Delta P_e$	$W_9 = -0.471\ D_e^2 \times (\Delta P_e + 1.67\ P_e)$	Surface pressure outside casing.	P_e—surface pressure outside casing when cement sets, psi. ΔP_e—change in surface pressure outside casing when cement sets, psi.
$B_8 = 0.314\ D_i^2\ \Delta P_i$	$W_{10} = 0.471\ D_i^2 \times (\Delta P_i + 1.67\ P_i)$	Surface pressure inside casing.	P_i—surface pressure inside casing when cement sets, psi. ΔP_i—change in surface pressure inside casing when cement sets, psi.
$B_9 = 0.0163\ D_e^2 \times (d_e + \Delta d_e) \times (m + 0.75\ m^2/L)$	$W_{11} = 0.0245\ D_e^2 \times (d_e + \Delta d_e) \times (m - 0.5\ m^2/L)$	Drop of fluid level outside casing.	m—fluid level drop outside casing after cement sets, ft.
$B_{10} = 0.0163\ D_i^2 \times (d_i + \Delta d_i) \times (n + 0.75\ n^2/L)$	$W_{12} = -0.0245\ D_i^2 \times (d_i + \Delta d_i) \times (n - 0.5\ n^2/L)$	Drop of fluid level inside casing ($n =$ or $< L$)	n—fluid level drop inside casing after cement sets, ft.

Note: All Δ quantities are plus for increase, minus for decrease.

the result of several studies[1,2,4] on the subject which concluded that for certain conditions, buckling occurs to pipe subjected to axial tension, and for other conditions, buckling will not occur under axial compression. These findings introduced a paradox.

For a number of years prior to these buckling studies it was believed that a small amount of axial compression would cause buckling in long and slender oil-well tubular members. For this reason many operators adopted landing practices which placed axial tension at and above the freeze point.

New concepts indicate that casing did buckle in some of the wells completed with these old landing practices. This has been difficult to reconcile since in most cases the operator had no evidence of failure and experienced no difficulty in completing and producing wells with buckled casings. The apparent contradiction of buckling theory with field experience lies in a misunderstanding of buckling phenomena and not in an incorrect buckling theory.

Types of buckling . . . There are three types of buckling that are familiar to most of us. The first type occurs in a beam which has been overloaded to the point of yielding. It is often said that the beam has buckled; however, this is perhaps incorrect nomenclature. It would be more proper to say that the beam has failed by yielding.

The second type of buckling occurs when a thin-wall cylinder or tank is subjected to high end loading. Under a critical load the sides of the vessel distort into a corrugated surface and the height of the vessel decreases appreciably. This is the classic case of symmetrical buckling.

The third type of buckling occurs when a column is subjected to its critical load. The column deflects from its vertical alignment and, depending on the intensity of the load and the

properties of the column, it may not return to its original alignment when the load is removed. This is the classic case of asymmetrical buckling.

Effects . . . The third type of buckling has been investigated as a criterion for landing casing. This type buckling is most familiar since it occurs in certain sizes of drill pipe and tubing that are racked in the derrick. The drill pipe and tubing may bow from a straight alignment but they have not failed. They will return to their original alignment if laid on a flat surface or picked up in the derrick.

Casing that has buckled down the hole will return to its original alignment after the buckling forces are removed, if the yield stress of the casing is not exceeded. Parting or permanent deformation probably seldom occurs in buckled casing. If a large cavity is opposite the buckled section, the casing will tend to bow into the enlargement. In such an event the casing could be permanently distorted. Trouble would probably first be experienced in passing other strings or tools through the buckled section.

Texter[5] reports on one failure of 5½-in. casing that was evidently the result of wear caused by rotation of the tubing string which had drilled out the cement plug. Investigation indicated that the casing had buckled into a cavity, permitting the drilling tubing to rub hard against the convex side of the buckle.

There may be many casing failures that have been aggravated by buckled casing. It is understandable that there is a lack of information on this subject since in past years we have not suspected that the casing was buckled, and in recent years the tools for examining buckling tendencies have been difficult to understand and apply.

Buckling Criterion Equation

Table 1 presents the equation for determining the required pickup to preclude buckling of the casing after the cement sets. Negative values of the buckling-criterion expression indicate that slackoff in the amount indicated can be permitted without causing buckling of the casing. Fig. 1 illustrates the parameters used in the equation.

In using the equation, an estimate is first made of the down-the-hole conditions which exist or will exist at the time the cement sets sufficiently to fix the casing shoe. Second, an estimate is made of the change in those conditions which will occur during the drilling or producing history of the well. These estimated initial and changed conditions give values for the parameters in the equation. Solution of the equation yields the required pickup or allowable slackoff which should be applied at the time the casing is hung.

Several solutions . . . In the actual case, several solutions of the equation will be necessary to evaluate the optimum hanging loads for precluding buckling during the several drilling, producing, or workover conditions. For example, during drilling below the shoe of the casing string, a change in the internal mud weight and the average temperature above the cement top may occur. This will require a certain hanging load to preclude buckling.

When the well is on production the same casing string will be subjected to an environment different from the as-cemented or drilling-ahead environment. This production environment will also dictate an optimum hanging load for precluding buckling.

The same holds true for workover conditions. A selection of the largest of the several optimum hanging loads will insure that no buckling of the casing will occur under any of the conditions investigated.

Weights of casing . . . The buckling equation has been derived for single-weight casing strings. A study of equations for combination weight strings indicates that no significant error is introduced in using the single weight equations for evaluating buckling tendencies of common designs of combination-weight strings.

Certain considerations may be given to combination strings in the equations of Table 1. In the term hw, w is defined as the weight per foot of casing below the cement top. In the combination-weight strings, w may have two or more values below the cement top. In this case the term, hw, should be taken as equal to the weight in air of pipe below the cement top.

In a similar manner the factor w′ in the temperature-effect term may be taken as the average weight of casing above the cement top. The value of D_i, inside diameter, may be selected to correspond to the weight of pipe of the longest section above the cement top. In general the accuracy of the buckling theory does not justify a more exact solution.

Freeze point . . . The equation assumes the freeze point to be at the cement top. Freeze points determined by stretch curves and strain instruments are frequently found to be considerably above the cement top.

In general, after setting casing, the freeze point moves very rapidly from the cement top to the shoe of the next largest size of casing. This high freeze point is believed to be of a temporary nature, and the effect of a prolonged change in the environment of the casing will eventually be felt at the permanent freeze point, the top of cement.

Oberg and Masters[6] determined by strain measurements on the top joint of casing in two wells that the freeze point at the shoe of the surface string was indeed of a temporary nature. They concluded that ". . . freeze points above the top of the cement may not hold the casing in a fixed position. In choosing a landing tension in such wells, all of the casing to the top of the cement should be considered as possibly being free to move."

If it is concluded that a permanent freeze point has been established above the top of the cement, the buckling equation is still valid provided the value of h is taken equal to the distance from the casing shoe to the permanent freeze point and the value of L is taken equal to the distance from the permanent freeze point to the casing hanger.

Wellhead Load Equation

The selected hanging load for the casing should be compatible not only with buckling requirements, but also with the strength of the casing itself, the strength of the outer casing strings, and the load-carrying capacity of the casing-hanging assembly. Several manufacturers are providing casing-hanging assemblies which can resist loads larger than the joint strength of casing, therefore the load on the assembly is not as critical now as in the past.

Table 1 shows the equation for use in determining the wellhead load. The parameters in the equation are identical to those used in the buckling-criterion equation.

The wellhead-load equation can be used to evaluate the load at any time in the history of the drilling or producing well. It, therefore, becomes a valuable aid in the design of the casing string as well as in the study of buckling.

Combination strings . . . The wellhead-load equation has been derived for single-weight strings, but it can be used satisfactorily for combination-weight strings by procedures similar to those outlined for the buckling equation.

Note that the sum of terms W_3 through W_6 in Table 1 is equal to the hanging weight of the string while waiting for the cement to set. If the casing or casing annulus is shut in under pressure P_i or P_e respectively while waiting for the cement to set, then part of terms W_9 and W_{10} can also be included in the initial hang-

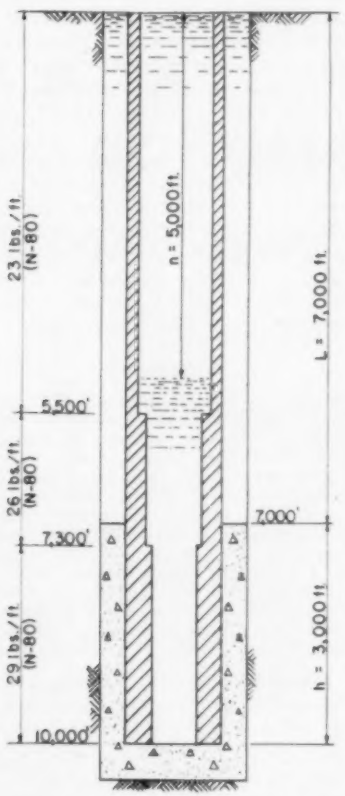
ing load. By substituting the initial hanging load for the sum of these terms, the wellhead-load equation becomes quite accurate for combination strings.

Drag . . . When the plug bumps, caution should be exercised in accepting the load on the rig's weight indicator as the hanging load that will exist when the cement sets. Initial drag of the casing, centralizers, and scratchers may be appreciable. After several hours, the casing may have slipped farther down the hole and increase the wellhead load to that value which will exist when the cement sets.

A considerable amount of the drag may still be in the casing when the cement sets. In this case the wellhead-load equation developed in this paper should be adjusted by subtracting the amount of "locked-in" drag.

Example Problem

A 10,000-ft. combination-weight string of 7-in. o.d. casing has been selected for illustrating the application of the buckling and wellhead-load equations. Weight per foot, grade, and length of section in this string are shown in Fig. 2. The casing will be examined for four down-the-hole conditions.



SEVEN-INCH CASING string used for example problem. Buckling criterion and wellhead load are examined for four cases. Fig. 2.

1. Condition when cement sets.

(a) Buckling criterion.

Only terms B_2, B_3, and B_4 (Table 1) apply when the cement sets. There are two weights of casing below the cement top in the example problem, hence the term B_2 is equal to the weight in air of casing below the cement top.

The factor D_i appears in term B_4 and according to Table 1, the value of D_i for this term is equal to i.d. of casing below the cement top. Sufficient accuracy will be obtained by using the i.d. of 29-lb. pipe even though a small amount of 26-lb. pipe is below the cement top.

Evaluation of the terms yields:

$$B_2 = -(300)\ (26) - (2{,}700)\ (29) = -86{,}100 \text{ lb.}$$
$$B_4 = -0.0408\ (6.184)^2\ (3{,}000)\ (13) = -60{,}800 \text{ lb.}$$
$$B_3 = +0.0408\ (7)^2\ (3{,}000)\ (15) = +90{,}000 \text{ lb.}$$
$$B_2 + B_3 + B_4 = -56{,}900 \text{ lb.}$$

Thus when the cement sets, the casing can be slacked off 56,900 lb. without causing buckling.

(b) Wellhead load.

Terms W_3 through W_6 (Table 1) should be used to determine the hanging load of the casing when the cement sets. If the casing or casing annulus is shut in under a pressure P_i or P_e respectively when waiting for cement to set, then terms W_9 and W_{10} must also be included to determine the hanging load when the cement sets.

Term W_3 for combination weight strings is equal to the weight in air of the entire string. Term W_6 includes a factor D_i which for combination strings should be taken approximately equal to the average i.d. in the string. For this term the i.d. for 26-lb. pipe will be used.

Evaluation of the terms yields

$$W_3 = (23)\ (5{,}500) + (26)\ (1{,}800) + (29)\ (2{,}700) = +251{,}600 \text{ lb.}$$
$$W_4 = -0.0408\ (7)^2\ (3{,}000)\ (15) = -90{,}000 \text{ lb.}$$
$$W_5 = -0.0408\ (7)^2\ (7{,}000)\ (13) = -181{,}900 \text{ lb.}$$
$$W_6 = +0.0408\ (6.276)^2\ (10{,}000)\ (13) = +208{,}900 \text{ lb.}$$
$$W = W_3 + W_4 + W_5 + W_6 = +188{,}600 \text{ lb.}$$

Thus the hanging load when the cement sets is 188,600 lb.

2. Condition when deepening.

After setting the 7-in. o.d. casing at 10,000 ft., assume the hole is deepened and the mud weight is increased from 13 to 18 lb. per gal. Also, the circulated mud will be considerably hotter from the greater depths. In this example assume that the average temperature of the casing above the cement top increases 35° from the average temperature existing when the cement set. These changes in environment introduce the following changes in buckling and wellhead loads.

(a) Buckling.

$$B_1 = +59.8\ (23)\ (35) = +48{,}100 \text{ lb.}$$
$$B_6 = +0.0286\ (6.366)^2\ (7{,}000)\ (5) = +40{,}600 \text{ lb.}$$
$$\Delta S = B_1 + B_6 = +88{,}700 \text{ lb.}$$

In order to offset the effect on buckling of a 35° increase in average temperature above the cement top and an increase of 5 lb. per gal. of internal mud weight, the casing must be picked up 88,700 lb. When combined with the 56,900 lb. that the casing could be slacked off when cemented, the casing must be picked up a net of 31,800 lb. from the as-cemented position if buckling is to be prevented when drilling ahead.

(b) Wellhead load.

$$W_2 = -59.8\ (23)\ (35) = -48{,}100 \text{ lb.}$$
$$W_8 = +0.0122\ (6.366)^2\ (7{,}000)\ (5) = +17{,}300 \text{ lb.}$$
$$W_2 + W_8 = -30{,}800 \text{ lb.}$$

When drilling ahead the wellhead load decreases 30,800 lb. If the casing was hung as cemented, the wellhead load when drilling ahead would be 188,600 − 30,800 = 157,800 lb.

3. Condition when testing a liner.

If a liner is set and it is desired to test the liner by pressuring the 7-in. o.d. casing to 2,000 psi. with 18-lb. per gal. mud in the hole, another change will occur in the as-cemented buckling and wellhead load character-

istics. Assume at the time of testing the liner that the average temperature of the 7-in. casing above its cement top returns to the as-cemented value; hence Δt is zero.

(a) Buckling.

$$B_6 = +0.0286\ (6.366)^2\ (7{,}000)\ (5) = +40{,}600 \text{ lb.}$$
$$B_8 = +0.314\ (6.366)^2\ (2{,}000) = +25{,}500 \text{ lb.}$$
$$B_6 + B_8 = +66{,}100 \text{ lb.}$$

Thus when the casing is hung, the net required pickup to prevent buckling when the liner is tested is 66,100 − 56,900 = 9,200 lb.

If the well had been shut in with 1,000 psi. when waiting for the cement to set behind the 7-in. casing, then the value of ΔP_1 in term B_8 would be 2,000 − 1,000 = 1,000 psi.

(b) Wellhead load.

$$W_8 = +0.0122\ (6.366)^2\ (7{,}000)\ (5) = +17{,}300 \text{ lb.}$$
$$W_{10} = +0.471\ (6.366)^2\ (2{,}000) = +38{,}200 \text{ lb.}$$
$$W_8 + W_{10} = +55{,}500 \text{ lb.}$$

When testing the liner, the wellhead load increases 55,500 lb. above the load that was hanging on the elevators when the cement set. If the casing was hung as cemented, the wellhead load when testing the liner would be 188,600 + 55,500 = 244,100 lb.

4. Condition when producing on gas lift.

For this condition the fluid weight in the casing is taken as 8.7 lb. per gal. and the fluid-level drop in the casing is assumed to be 5,000 ft. No temperature change is assumed from the as-cemented temperature. The supply gas is injected in the casing at 900 psi.

(a) Buckling.

$$B_6 = +0.0286\ (6.366)^2\ (7{,}000)\ (-4.3) = -34{,}900 \text{ lb.}$$
$$B_8 = +0.314\ (6.366)^2\ (900) = +11{,}500 \text{ lb.}$$
$$B_{10} = -0.0163\ (6.366)^2\ (8.7)\ (7{,}680) = -44{,}100 \text{ lb.}$$
$$B_6 + B_8 + B_{10} = -67{,}500 \text{ lb.}$$

Thus when the casing is hung, the maximum slack-off that can be allowed in order not to cause buckling at the time the well is on gas lift is

$$(-56{,}900) + (-67{,}500) = -124{,}400 \text{ lb.}$$

(b) Wellhead load.

$$W_8 = +0.0122\ (6.366)^2\ (7{,}000)\ (-4.3) = -14{,}900 \text{ lb.}$$
$$W_{10} = +0.471\ (6.366)^2\ (900) = +17{,}200 \text{ lb.}$$
$$W_{12} = -0.0245\ (6.366)^2\ (8.7)\ (3{,}210) = -27{,}700 \text{ lb.}$$
$$W_8 + W_{10} + W_{12} = -25{,}400 \text{ lb.}$$

When the well is producing on gas lift the wellhead load decreases 25,400 lb. from the hanging load when the cement sets. If the casing was hung as cemented the wellhead load when on gas lift would be 188,600 − 25,400 = 163,200 lb.

5. Summary of example problem.

In the four conditions examined, the required maximum pickup occurs for the condition of deepening the well. The wellhead loads would be (1) 220,400 lb., (2) 189,600 lb., (3) 275,900 lb., and (4) 195,000 lb. if this maximum pickup of 31,800 lb. is applied. The minimum design factor against joint pullout is 1.45. This occurs when the liner is tested.

In order to hang the casing with 31,800 lb. additional load it is required to pick up the casing 13.4 in. from the cemented position. (See conversion, Table 1.)

If at the time of hanging casing a temporary freeze point should exist at the shoe of the surface string, at say 2,000 ft., then a pickup of 13.4 in. will require 112,000 lb. additional pull instead of 31,800 lb. A pickup of 112,000 lb. will increase the hanging load to 112,000 + 188,600 = 300,600 lb. and the design factor against pullout would be 400/300.6 = 1.33.

If the freeze point at the shoe of the surface string is temporary, the large hanging load of 300,600 lb. will decrease to 220,400 lb. as the casing adjusts down to the permanent freeze point at the cement top. If the shoe of the surface string is the permanent freeze point, then a pickup of 112,000 lb. would mean that 244,100 + 112,000 = 356,100 lb. would be on the casing hanger when the liner is tested. The design factor against pullout would be 400/356.1 = 1.12. This would be a very undesirable design factor for tension.

A pickup of 31,800 lb. with a temporary freeze point at 2,000 ft. will require (13.4) (2/7) = 3.8 in. pickup. When the casing adjusts down to the cement top at 7,000 ft., the net pickup in pounds will be (31,800) (2/7) = 9,100 lb.

This would mean that the casing would still buckle when drilling ahead with 18-lb. per gal. mud and would be on the verge of buckling when the liner is tested. Buckling may not occur when the liner is tested if the short interval of time required for testing is not sufficient for the freeze point at 2,000 ft. to move back down to the cement top.

Buckling of Tubing on Packer

The buckling of wellhead-load equations can be used to examine tubing set on a packer. For tubing the parameter h is equivalent to the length of packer and may be taken as zero. The value of L is then the distance from packer to tubing hanger.

For studies of buckling of tubing in pumping wells the paper by Lubinski and Blenkarn[7] will serve as an excellent reference. It is of interest to note that Lubinski and Blenkarn's general equation (5) for buckling of tubing can be determined from the buckling expression presented in Table 1 of this paper by exchange of equivalent symbols and by correcting for a fluid level drop that exists when the packer is set. The fluid-level correction is made by evaluating buckling terms B_9 and B_{10} for the condition when the packer is set and subtracting their sum from the buckling condition when the well is on pump.

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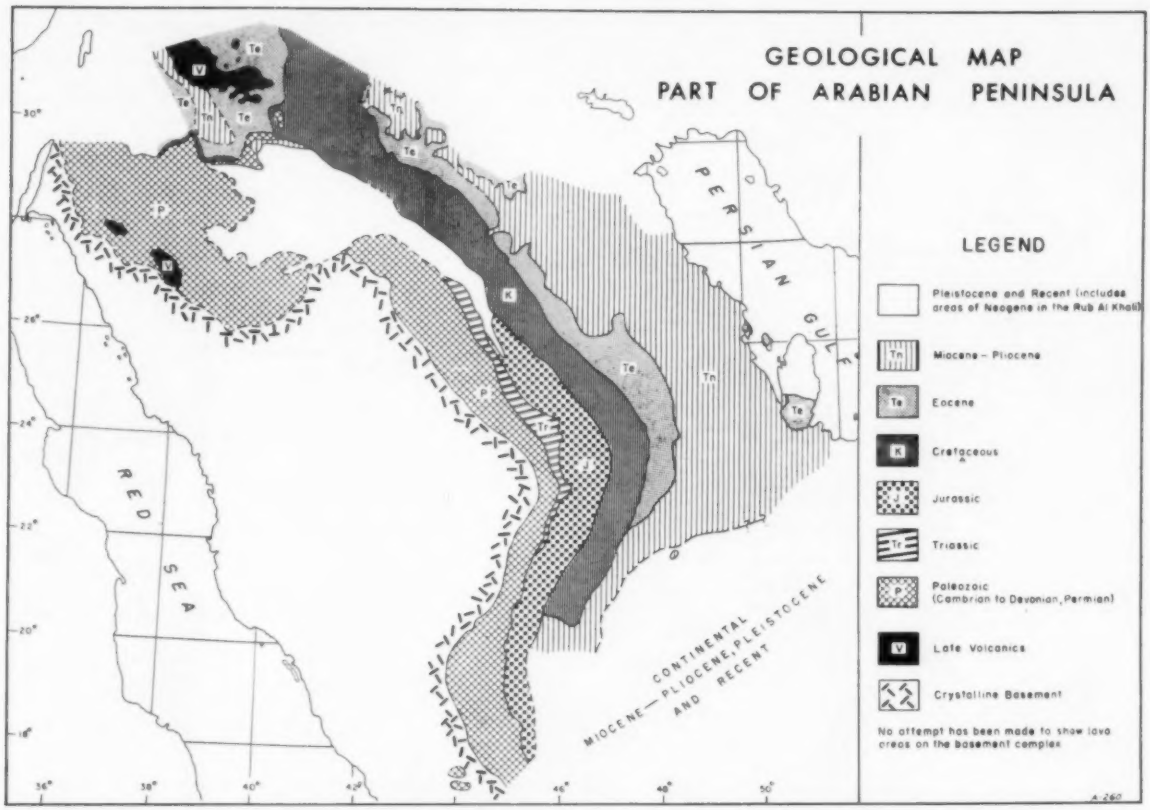


THERE IS MARKED SIMILARITY between the geological map (above) and the physiographic province map which was published with Part 1. Production is found on the Hasa structural terrace that roughly parallels the Persian Gulf. Fig. 4.

Basic Pattern of Exploration in Saudi Arabia Remains Unchanged

Stratigraphy important, but emphasis is still on structure

By Warren H. Thralls and R. C. Hasson

PART 2 OF 2 PARTS

SAUDI ARABIA is one of the world's most important oil-producing countries. Oil reserves are estimated conservatively at 34 billion barrels. Production was 361 million barrels in 1956.

This article is devoted to stratigraphy and structure, and to handling and processing of the produced oil. Part 1, OGJ, July 15, 1957, p. 84, was devoted to exploration and development, physiographic provinces, and some background on the area.

Authors are with Arabian American Oil Co.

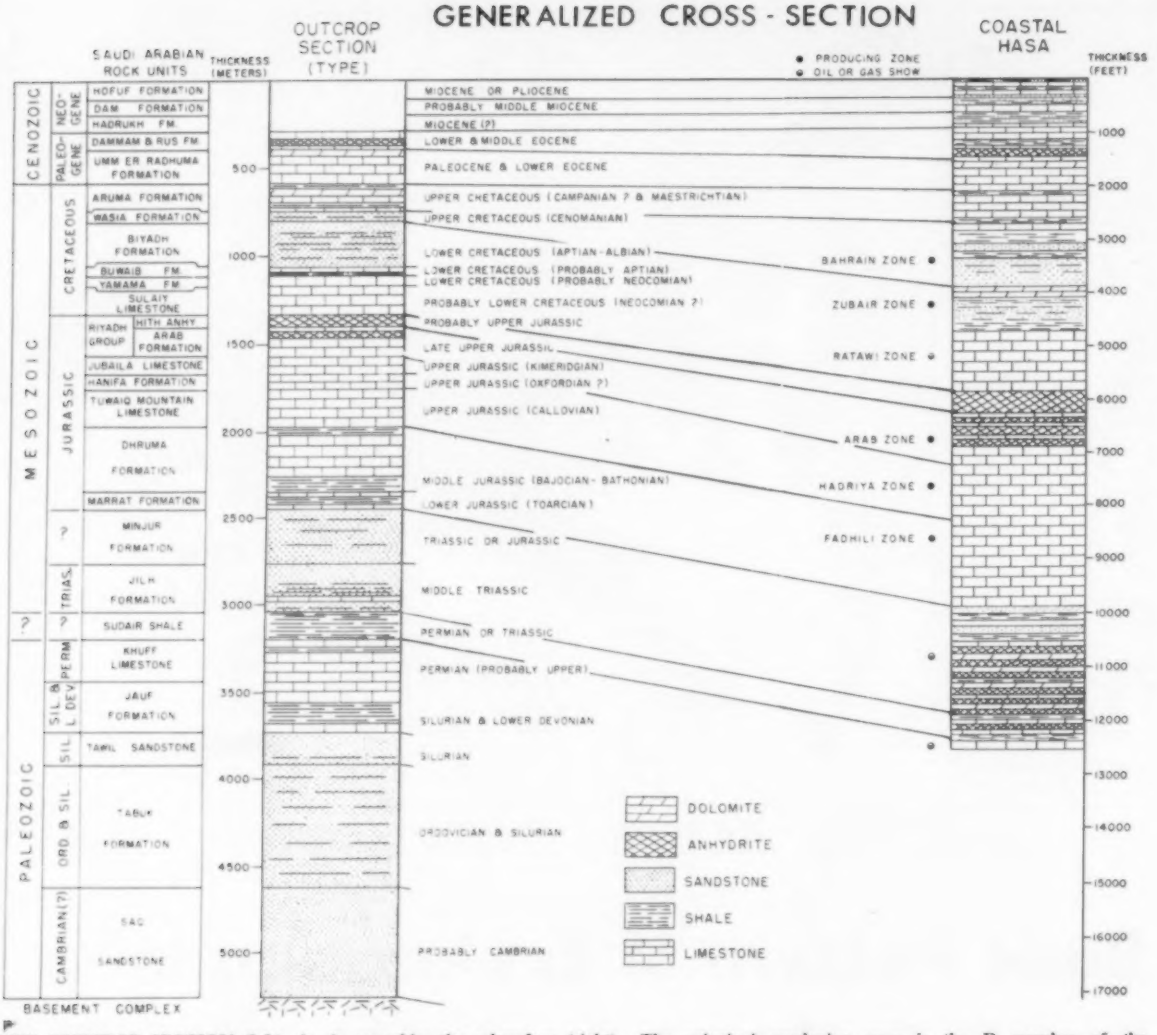
Stratigraphy

The pre-Permian Paleozoic rocks are sandstones, micaceous siltstones and shales (Table 1, Figs. 4-5). In spite of the large thickness of the beds involved, only a minor amount is shale, and most of this does not appear to have been strongly organic.

The one unit which does include appreciable amounts of organogenic sediments (limestones) is the Jauf formation (Silurian and Lower Devonian). Available information indicates that the Jauf formation is restricted to an area bordering the northwestern edge of the Great Nefud.

Permian-Triassic . . . The Permian is represented in outcrop by the Khuff formation (probably Upper Permian) and possibly the overlying Sudair shale (Permian or Triassic). The Khuff consists of alternating chalky and dense limestones commonly with thin, hard shelly limestone layers. In some places it is considerably dolomitized.

Cream-colored marls and red and green gypsiferous clays occur in moderate amounts in the upper half of the unit and sporadically in thin beds through the remainder. In the coastal section the Khuff is probably shallow-water limestone deposits with some intercalated thin beds of anhydrite. Evi-



THE OUTCROP SECTION (left) closely resembles the subsurface (right). The principal producing zone is the D member of the Arab zone. Fig. 5.

dence of gas has been encountered in the Khuff in coastal wells.

The Triassic in outcrop is predominantly sandstone with minor amounts of red to green shales and impure limestones. The underlying Sudair shale and overlying Minjur sandstone, here placed in the Triassic, are poorly dated and may possibly be Permian and Jurassic respectively.

The coastal Hasa section assigned to the Triassic is composed of a lower unit of limestone, anhydrite and red and green shales, a middle dolomite-anhydrite series, and an upper shale-sandstone unit. Oil shows have been encountered in the dolomite-anhydrite series.

Jurassic . . . The Lower Jurassic is represented in outcrop by the Marrat formation (Toarcian) which in its typical development consisted of upper and lower limestone-dolomite units separated by a red shale member which is locally interbedded with sandstone.

In the coastal area the Marrat has not been distinguished because of the lack of paleontological evidence, but its equivalent is probably a dark, dense, argillaceous limestone which separates dated Middle Jurassic rocks above and the underlying presumed Triassic.

At the outcrop, the Middle Jurassic Dhruma formation (Bajocian-Bathonian) is in a shallow-water facies and is composed primarily of limestone, with shale in the upper and lower parts. Clean current-washed calcarenites occur as thin members at various levels.

In the coastal area fine-grained limestones, often dense and sometimes dark and argillaceous, dominate but variable proportions of fine calcarenite, usually with a fine lime mud matrix, are interbedded. The oil of Fadhili field is found in a persistent fine calcarenite a short distance below the top of the Dhruma.

Upper Jurassic . . . Rock units assigned to the Upper Jurassic are the Tuwaiq Mountain limestone (Callovian), and Hanifa formation (Oxfordian?), the Jubaila limestone (Kimeridgian), the Arab formation (late Upper Jurassic), and the Hith anhydrite (probably Upper Jurassic). The two lowermost units, the Tuwaiq Mountain limestone and the Hanifa formation, are important topographically in Central Arabia but are known so far only in that portion of Arabia.

Neither has been recognized in coastal wells and available paleontological evidence suggests that the two units must be either highly condensed or entirely lacking. Along its belt of outcrop in Central Arabia the

Table 1—Saudi Arabian Rock Units

ROCK UNITS	MAIN ROCK TYPES	THICKNESS (TYPE SEC	AGE
Hofuf formation	Sandy marl and limestone; local quartz gravel at base	95m	Miocene or Pliocene
Dam formation	Shale, marl and limestone, with chert	90m	Probably Middle Miocene
Hadrukh formation	Sandstone, shale, marl & chert	84m	?Miocene
Unconformity			
Dammam formation	Limestone, dolomite, clay and marl	28m	Lower and Middle Eocene
Rus formation	Anhydrite, marl, shale and limestone	56m	Lower Eocene
Umm er Radhuma formation	Mainly limestone and dolomite	About 217m	Paleocene and Lower Eocene
Aruma formation	Limestone, with dolomite and shale	144m	Late Upper Cretaceous (Campanian? and Maestrichtian)
Unconformity			
Wasia formation	Sandstone and shale with subordinate limestone	42m	Early Upper Cretaceous (Cenomanian)
Unconformity			
Biyadh sandstone	Sandstone, with shale	About 270m	Lower Cretaceous (Aptian - Albian)
Buwaib formation	Limestone, with subordinate shale and sandstone	34m	Late Lower Cretaceous (Probably Aptian)
Unconformity			
Yamama formation	Calcarenite and fine-grained limestone	58m	Lower Cretaceous (Probably Neocomian)
Sulaiy limestone	Limestone, with a basal calcarenite unit	About 180m	Probably Lower Cretaceous (?Neocomian)
Disconformity			
Riyadh group			
Hith anhydrite	Anhydrite	71m	Probably Upper Jurassic
Arab formation	Limestone, dolomite and anhydrite	127m	Late Upper Jurassic
Jubaila limestone	Limestone	About 100m	Upper Jurassic (Kimeridgian)
Hanifa formation	Limestone	101m	Upper Jurassic (?Oxfordian)
Tuwaiq Mountain Limestone	Limestone, mainly coral-bearing	215m	Upper Jurassic (Callovian)
Unconformity			
Dhruma formation	Limestone, and shale	383m	Middle Jurassic (Bajocian - Bathonian)
Marrat formation	Limestone, dolomite and red shale	111m	Lower Jurassic (Toarcian)
Unconformity			
Minjur sandstone	Sandstone, with varicolored shale	315m	Triassic or Jurassic
Jilh formation	Sandstone, shale and limestone	About 326m	Middle Triassic
Sudair shale	Mainly red shale	116m	Permian or Triassic
Khuff limestone	Limestone, with shale and marl	235m	Permian (Probably Upper)
Unconformity			
Jauf formation	Limestone and shale	276m	Silurian and Lower Devonian
Tawil sandstone	Sandstone	Over 200m	Silurian
Tabuk formation	Sandstone and shale	About 725m	Ordovician and Silurian
Saq sandstone	Sandstone	Over 600m	Presumably Cambrian
Unconformity			
Basement complex			

Jubaila limestone is dominantly of shallow-water facies. Fine-grained limestone with layers of cleanly washed calcarenite prevail. In coastal Hasa the basal part is mainly dark, usually black, argillaceous limestone with varying amounts of black calcareous shales.

The upper five-sixths of the Jubaila is primarily fine-grained limestones interbedded with varying amounts of fine-grained calcarenite. Clean calcarenite, often coquinal, is limited to thin layers in the uppermost part. The Jubaila is productive in Abu Hadriya and in the Abqaiq area.

Arab formation . . . Rocks of the Arab formation show increased paleogeographic differentiation over those of the Jubaila, particularly in the coastal area, although the general pattern of lateral change seems to be simple. Little is known of the true rock sequence of the outcrop as extensive solution-collapse phenomena have nearly eliminated outcrops of the anhydrite. For this reason a subsurface section has been used as a type section.

The Arab is composed of rocks laid down between four main cycles of desiccation, each of which starts at the base with apparently normal marine limestone deposition. The carbonate portions of the four cycles have been designated informally "A," "B," "C," and "D" members in order from top to bottom. The "D" member is the principal oil-productive zone with minor local accumulations in the other members.

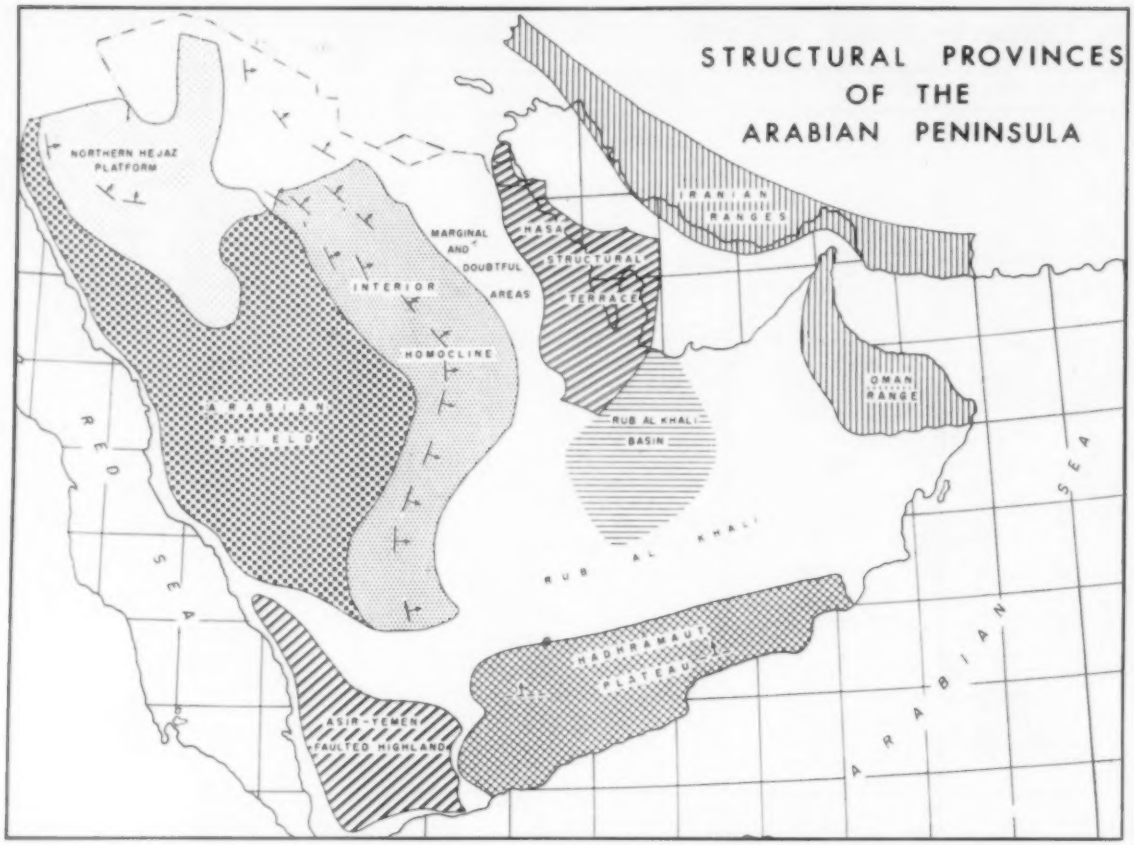
Optimum reservoir conditions are present in the "D" member in the northeastern Ghawar and Abqaiq areas. The "D" member in these areas is a calcarenite, primarily of the pellet type although there is considerable true oolite with well-developed concentric structure. True oolite is nearly absent in Central and southern Ghawar. In contrast, the "D" member of Dammam, Qatif, Bahrain, and Qatar shows extensive facies change from fine-grained limestone to calcarenite.

To the south in Ghawar the proportion of anhydrite between the "C" and "D" members progressively increases at the expense of the carbonate rocks of the "D" member. The overall thickness of the "D" member plus that of the anhydrite between "C" and "D" members is nearly constant over this same area. Information now available on the "D" member suggests that the area of thick development of clean, current-washed calcarenite was a bar or the margin of a shelf.

Apparently to the west, rocks of lagoonal facies occur instead of the calcarenite whereas a deeper water facies, composed mainly of lime mud deposits, seems to have been present to the east. The upper thinner limestone units, the "A," "B," and "C" members, show far less extensive oil accumulation than the "D" member. They also show more rapid increase of anhydrite to the south and west at the expense of the limestone.

No fossils have been found in the Hith anhydrite but it is presumed to be Upper Jurassic since it seems to close the depositional cycle which started with the Arab formation of apparent late Jurassic age.

Cretaceous . . . Saudi Arabian rock units assigned to the Lower Creta-



SAUDI ARABIA has a fairly simple structural pattern and resembles closely part of Canada with its central shield area. Fig. 6.

ceous are the Sulaiy limestone (Neocomian?), the Yamama formation (probably Neocomian), the Buwaib formation (probably Aptian), and the Biyadh sandstone (Aptian-Albian). The Sulaiy is a compact, fine-grained limestone with occasional layers of calcarenite and minor amounts of anhydrite at the base. The Yamama is a calcarenite alternating with fine-grained limestone.

Exact equivalents of the Buwaib formation and Biyadh sandstone of the outcrop have not been worked out for the coastal section. Above the Yamama in the coastal section, however, are 1,600 ft. of Lower Cretaceous, a lower 700 ft. of limestone overlain by 650 ft. of sandstone and shale and an upper 250 ft. of dolomite and limestone.

The sandstone-shale unit is the equivalent of the Zubair producing zone of southern Iraq and is productive in Safaniya field. The Sulaiy and the Yamama have not produced oil to date in Saudi Arabia, but there have been shows in the Yamama (the approximate equivalent of the Ratawi zone which is productive in the Saudi Arabia-Kuwait Neutral Zone).

Upper Cretaceous rocks are represented by the Wasia formation (Cenomanian) and the Aruma formation (Maestrichtian and Campanian?). The Wasia in outcrop is only some 140 ft. thick as compared with a section of 1,200 to 1,800 ft. in coastal wells. The outcrop section is predominantly cross-bedded sandstone and red and green, silty shales.

The coastal section is composed of a lower 700 to 1,300 ft. of sandstone and shale with minor beds of lignitic shale in the lower part and an upper section averaging 500 ft. in thickness

TABLE 2—STATUS OF WELLS AS OF DECEMBER 31, 1956

	Completed								Uncompleted	
Field—	Producing	Oil	Drilling	Standing‡	Shut-in§	Observation	Injection	Total	Suspended	Drilling
Abqaiq	42	1	0	4	18	2	6	¶73	0	1
Abu Hadriya	0	0	2	1	0	1	0	4	0	0
Dammam	*29	†7	3	0	1	1	0	41	0	1
El Alat	0	0	1	0	0	0	0	1	0	0
El Jauf	0	0	1	0	0	0	0	1	0	0
Fadhili	0	0	0	1	0	0	0	1	0	0
Ghawar:										
'Ain Dar	44	0	1	6	2	2	0	55	0	1
Shedgum	11	0	1	0	0	1	0	13	0	0
'Uthmaniyah	33	0	2	10	0	3	0	48	1	0
Huiya	0	0	0	1	0	1	0	2	0	0
Haradh	0	0	0	7	0	1	0	8	1	0
Khursaniyah	0	0	0	1	0	0	0	1	0	1
Ma'aqala	0	0	1	0	0	0	0	1	0	0
Qatif	8	0	1	0	2	1	0	12	1	0
Safaniya	0	0	0	18	0	1	0	19	0	1
Stratigraphic well	0	0	1	0	0	0	0	1	0	0
Total	167	8	14	49	23	14	6	281	3	5

*Includes three producing gas wells. †Two gas wells abandoned due to excessive remedial requirements. ‡Standing oil well has oil to surface but no surface facilities. §Shut-in oil well is not producing. ¶Does not include water supply wells.

TABLE 3—OIL PRODUCTION IN SAUDI ARABIA

	Zones being produced—	Gravity, °A.P.I.	Min. depth (subsea, ft.)	Estimated productive area (acres)
Abqaiq	Arab-D*	37-38	5,592	87,000
Abu Hadriya	Hadriya producible	35-36	Unknown	Unknown
Dammam	Arab-A	35-36	3,940	12,000
	Arab-B	35-36	4,000	9,000
	Arab-C	35-36	4,170	7,000
	Arab-D	35-36	4,200	3,000
Fadhili	Fadhili producible	38	Unknown	Unknown
Ghawar:				
'Ain Dar	Arab-D	34-36	5,700	135,000
Shedgum	Arab-D	35-36	5,642	65,000
'Uthmaniyah	Arab-D	33-35	5,360	260,000
Haradh	Arab-D producible	32-33	5,064	50,000
Huiya	Arab-D producible	33-34	5,098	Unknown
Khursaniyah	Arab-A producible	31±	Unknown	Unknown
	Arab-B producible	31±	Unknown	Unknown
	Arab-C producible	31±	Unknown	Unknown
	Arab-D producible	31±	Unknown	Unknown
Qatif	Arab-C	31-32	6,850	21,000
	Arab-D	37-39	7,030	16,000
Safaniya	Bahrain producible	27	4,931	64,000
	Zubair producible	31	6,552	3,000

*Two wells at Abqaiq produce from the Jubaila and two from the Arab-C.

TABLE 4—PRODUCTION BY FIELDS IN BARRELS

Field—	Total, 1956	1956 Daily average	Cum. prod. through 1956
Abqaiq	105,064,173	287,061	1,229,404,050
Abu Hadriya	0	0	9,579
Dammam	17,202,454	47,001	353,780,133
Ghawar:			
'Ain Dar	113,467,977	310,022	678,520,605
Huiya	*7	.....	7
Shedgum	41,715,663	113,977	117,319,726
'Uthmaniyah	71,878,908	196,390	206,238,825
Qatif	11,594,107	31,678	82,459,352
Safaniya	*95	.....	95
Total	360,923,384	986,129	2,667,732,372

*Production samples.

composed of limestone and red and green shales. These sands (Bahrain zone) are productive in Safaniya field where they are divided into two units, a lower sand at the base followed by 150 ft. of shale and limestone and then an upper sand.

The Aruma formation is approximately 500 ft. thick at the outcrop type section and of comparable thickness in the coastal area. Lithology is essentially limestone with lesser amounts of shale at the base and at the top.

Post-Cretaceous . . . Paleogene rocks include the Umm er Radhuma formation (Paleocene-Lower Eocene), the Rus formation (Lower Eocene), and the Dammam formation (Lower and Middle Eocene). All are predominantly limestone and dolomite with minor amounts of marl and shale and, in the Rus formation, considerable anhydrite.

The Neogene consists of the Hadrukh formation (Lower Miocene?), the Dam formation (Miocene), and the Hofuf formation (Miocene or Pliocene). The lithology is largely sandstones, shales, sandy cherty limestones, and marls.

Structure

General . . . Fig. 6 shows the approximate outlines of the main structural provinces of the Arabian Peninsula. The western portion is covered, for the most part, by a Precambrian basement complex of igneous and metamorphic rocks partially overlain by volcanics in the west central portion and with major masses of extrusive volcanics in the Asir-Yemen Highland.

To the north and northwest of the Precambrian outcrops is a considerable area of Paleozoic rocks which dip gently east to northeast to nearly north. The entire western portion of the peninsula is a region substantially faulted by tensional and/or torsional shearing.

Bordering the shield on the east is a long arcuate belt called the interior homocline of Paleozoic, Mesozoic, and Eocene sediments which, in the northern segment, dip north-northeast at an average rate of not more than 4 m. per 100 km. Dips, in the southern segment of the homocline, are of about the same magnitude toward the east-southeast into the Rub' al Khali, a vast basinal area in which some exploratory work has been done, but which is still poorly known.

Infrequent shear lines with small displacement are found in both segments. Solution-collapse structures, minor local undulations, and linear structural features of very low relief are typical in the north. The homoclinal area is perhaps 1,200 km. long and 200 to 300 km. wide. Its eastern lower slopes are marginal or doubtful areas masked by Neogene sediments.

From the sparse data at hand, these slopes seem fundamentally a continuation of the interior homocline that may have been subjected to some structural disturbances and interruptions of sedimentation.

Hasa structural terrace . . . Immediately to the east of these marginal areas is the Hasa structural terrace, a slightly warped, relatively flat structural plane with minor undulations of low relief and irregular form. Structural elevations decrease progressively but very gradually to the northeast, east, and southeast. On this plane is superimposed a pattern of generally north-south trending, major anticlinal axes. All known productive areas of Saudi Arabia as well as those of nearby Kuwait, Bahrain Island, Qatar, and Kuwait Neutral Zone are within this structural province.

Although the Oman and Iranian ranges were subjected to strong, compressional deformation during the late Tertiary, no evidence of simultaneous tectonic activity of this order has been recorded in Central and Northeast Saudi Arabia. A limited amount of tensional faulting in Central Arabia may possibly have taken place as late as this.

Tilting, at various times, has resulted in unconformities at which truncation has eliminated older rocks on a regional scale at as low a rate as a fraction of a meter per kilometer. Some unconformities of this type are pre-Permian, pre-Lower Jurassic, pre-

Upper Jurassic, pre-middle Lower Cretaceous, and pre-Middle Cretaceous. Pre-Upper Cretaceous and pre-Miocene unconformities are manifested in truncation of beds on the crests of individual folds.

Producing areas . . . The two most important major anticlinal axes located within the Saudi portion of Hasa structural terrace are En Nala and Abqaiq-Qatif. The productive structures of Abqaiq and Qatif (Fig. 1, Part 1) are elongated anticlines which may have originated by deep-seated shearing. Associated with Abqaiq is a rather poor positive gravity anomaly, whereas Qatif shows a well-developed one.

Abqaiq is some 70 km. long by 20 km. wide with a gently curved major axis trending about N 15° E. It is an essentially symmetrical anticline with a low, broad northern extension and closure of about 1,500 ft. at the top of the Arab "D" member.

Qatif is slightly asymmetric, broad to the south, narrowing northward with its major axis trending N 20° W and slightly concave westward. About 350 ft. of closure is proved at the Arab zone with limiting closure to the west and south and the steeper flank on the east.

En Nala . . . This axis (Fig. 3, Part 1) extends from the southern tip of Haradh northward for a distance of 245 km. through the producible areas of Haradh and Juiya and the present productive areas of 'Uthmaniyah, Shedgum, and 'Ain Dar. These five areas are known collectively as Ghawar field. Beyond the northernmost producer of 'Ain Dar, the axis extends probably at least 165 more kilometers to include Fadhili field and the recent discovery of Khursaniyah.

The axis is made up of an essentially continuous series of linear anticlines with gentle north plunges. Subtle surface expression is seen in the south where elevations are greatest. Marked reflection of the axis on gravity maps plus the general linearity of the individual structures suggest origin as a result of shear along major basement weaknesses.

Perhaps coupled torsional effects may account for the variation in orientation of the different axes. Flank dips approach 10° to 12° at the producing zone with structural relief as great as 1,400 ft.

Haradh . . . This anticline (structure contour map Ghawar, Fig. 3, Part 1) is large and asymmetrical with a straight east flank and a long northern nosing into the Huiya area, with apparently no saddle between the two. Huiya is a north-plunging, narrow anticlinal fold with its plunge interrupted by minor closures. 'Uthmaniyah is an elongate anticline, apparently composed of two brachyanticlines, the western one considerably lower structurally. The western axis trends generally north-south and the eastern one north-south to approximately N 15° E where it joins Shedgum.

Shedgum is also an elongate anticline with its major axis trending N 15° E. 'Ain Dar is an elongate anticline with two structural highs separated by a saddle. The axis of the northern high trends in a north-south direction, while that to the south is oriented approximately N 15° E. A 19-km. north stepout to 'Ain Dar was comp'eted in early 1957.

Shallow structure of Fadhili, as determined by structure drilling, indicates a somewhat irregular brachyanticline elongated in a northwest-southeast direction, but this is subject to further check.

Dammam dome . . . This is not associated with any major anticlinal axis. It is a faulted dome with the longer axis trending about N 10° W and with a central graben, the bounding faults trending about N 60° W with throws up to 400 ft. dying out peripherally. Major faulting does not extend above the Wasia-Aruma unconformity.

The type of structure with the presence of a gravity minimum centered about 3 km. from the apex of the surface high has led to the supposition that Dammam dome is a shallow expression of a deep-seated salt plug. At the top of the Arab zone, closure is substantially over 700 ft.

Abu Hadriya is another dome elongated in the direction N 10° W. Its subsurface structure has not been delineated, and its origin is unknown. Two deep wells, the discovery somewhat down the north plunge and a second southeast of the discovery, indicate a relatively steep east flank. Closure may be as great as 1,200 ft. at the producible zone.

Safaniya is a structure considerably more elongate than Dammam and, on present evidence, somewhat more so than Abu Hadriya. It appears to be a relatively simple fold with an axial trend slightly east of north and with very gentle flank dips. Closure at the productive zone is of the magnitude of 550 ft.

Khursaniyah . . . A major discovery was made at Khursaniyah (Fig. 1, Part 1) in 1956. All of the Arab zone members are productive. Minor accumulations are present in the Cretaceous Upper sand (Bahrain zone) and in a zone in the Jubaila limestone not previously productive in Saudi Arabia. Structure drill and seismic data indicate that the structure is a dome with, compared to other Saudi Arabian structures, steep dipping flanks. Structural relief is in excess of 1,400 ft. of the producing zone.

Origin . . . A hypothesis is favored which confines potential source beds of Arab "D" member oil to the Jubaila and "D" member itself. First evidence of the growth of the individual structures in which "D" member oil is now found seems to have been in early Upper Cretaceous time, although it is probable that local structural disturbances occurred during the Lower Cretaceous.

Calcarenite lenses of the "D" member may have acted as stratigraphic traps to retain the oil in the general vicinity until the final concentration as a result of later folding. The same theory seems applicable to "A," "B," and "C" member oils.

Occurrence . . . A tabulation of Saudi Arabian commercial oil occurrences, characteristics of the oils, and general reservoir data is given in Table 3.

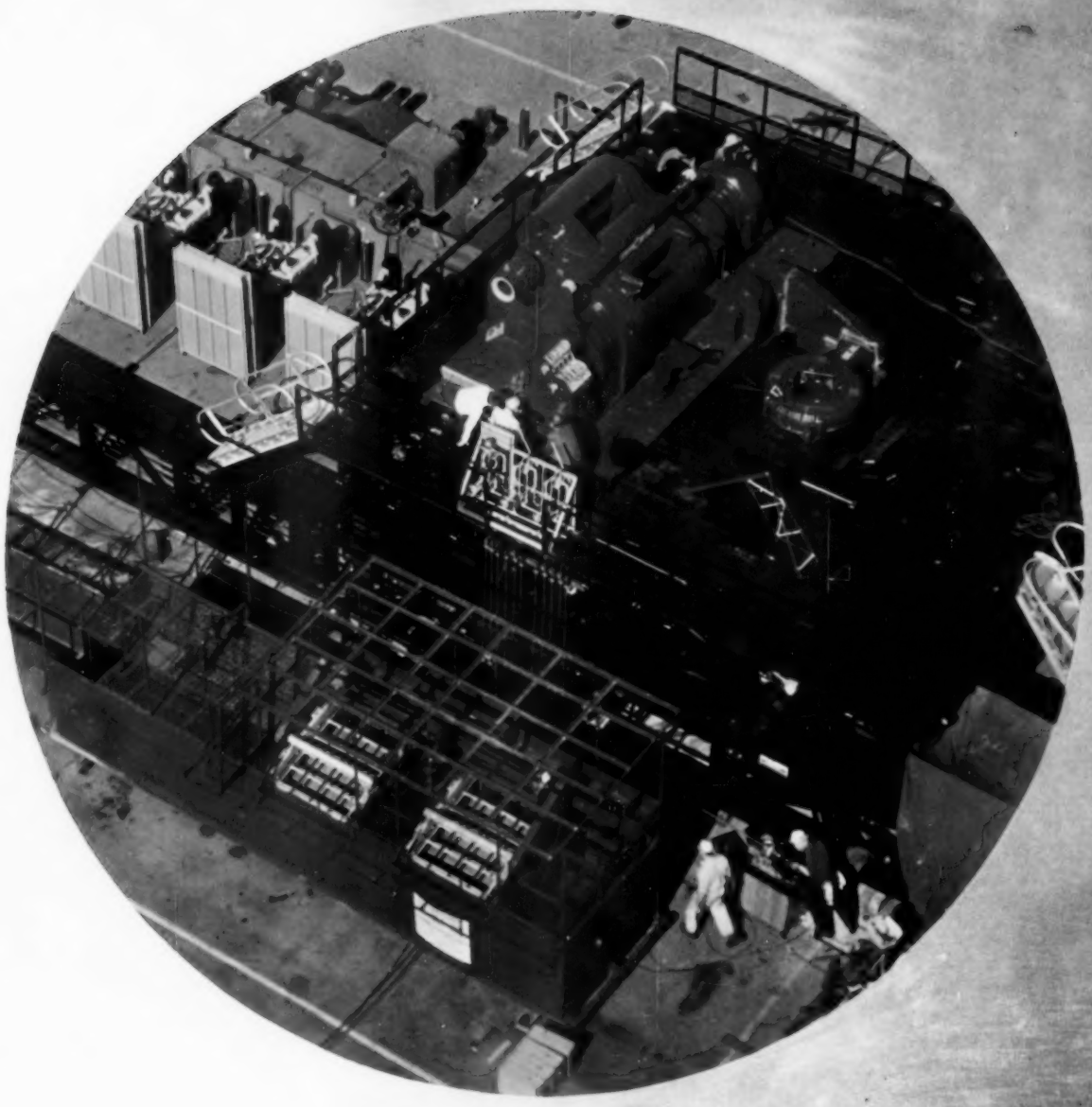
Handling and processing . . . The oil passes through one of 14 gas-oil separator plants to remove solution gas and, when it is to be shipped offshore, to one of three stabilizers for removal of hydrogen sulfide gas. It then may go to the Ras Tanura refinery (Aramco), the Bahrain Island refinery (Bahrain Petroleum Co., Ltd.), or, if to be shipped as crude and refined by the purchasers, direct to tanker at the Ras Tanura marine terminal or to Sidon on the Mediterranean through the 1,723-km. 30-31-in. Trans-Arabian pipeline system.

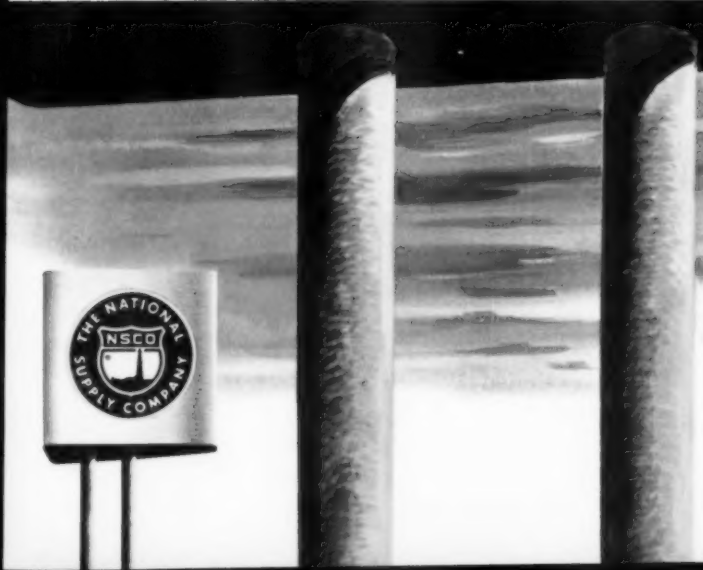
A total of 1,458 km. of gathering and trunk lines (10-in.-31-in.) serve the fields. Nominal capacity of Ras Tanura refinery is 189,000 bbl. per day.

At present only Abqaiq, Dammam, 'Ain Dar, Shedgum, 'Uthmaniyah, Qatif, and Safaniya have surface producing facilities. A pipeline, being built from Safaniya direct to Ras Tanura, was completed in the spring of 1957.

Production . . . Tables 4 and 5 show daily average production by fields for 1956, cumulative production by fields through 1956, and annual production for the years 1936 to 1956 inclusive.

Reserves . . . Reserves of Saudi Arabian fields were estimated to be 34 billions of barrels at end of 1955. **End.**





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Continued from previous page

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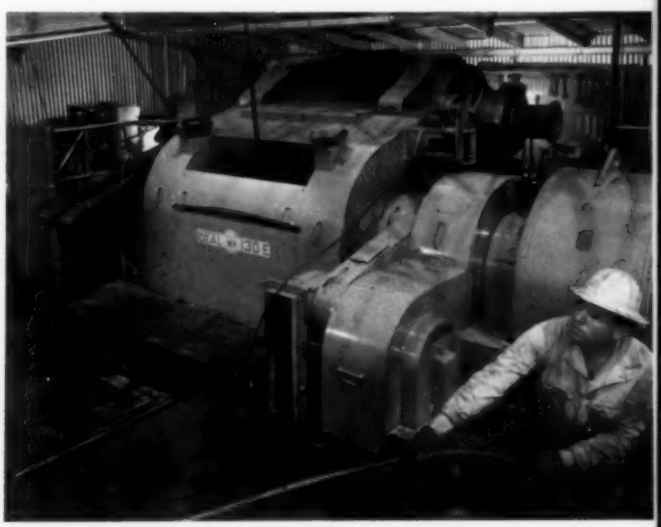

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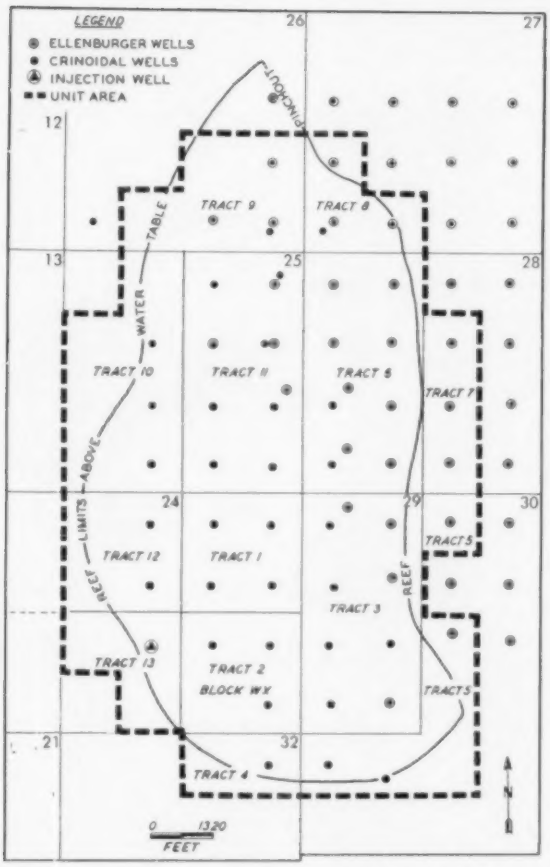
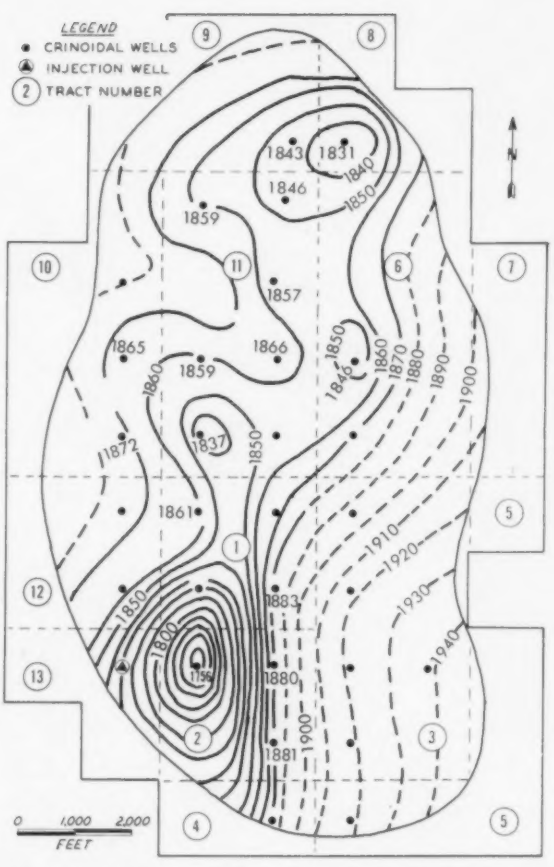


UNIT AREA MAP of the Todd crinoidal unit, Crockett County, Texas. Fig. 1.



SINCE FLOODING, pressure has risen from 1,744 to 1,874 psi. Fig. 2.

Reef formation gets unusual water pressuring. Result:

Recovery Estimates Hiked 60 Per Cent

Project Engineer Milton Barber, of Continental Oil, points out that . . .

Water injection through single input well not only halts b.h.p. decline, but increases it

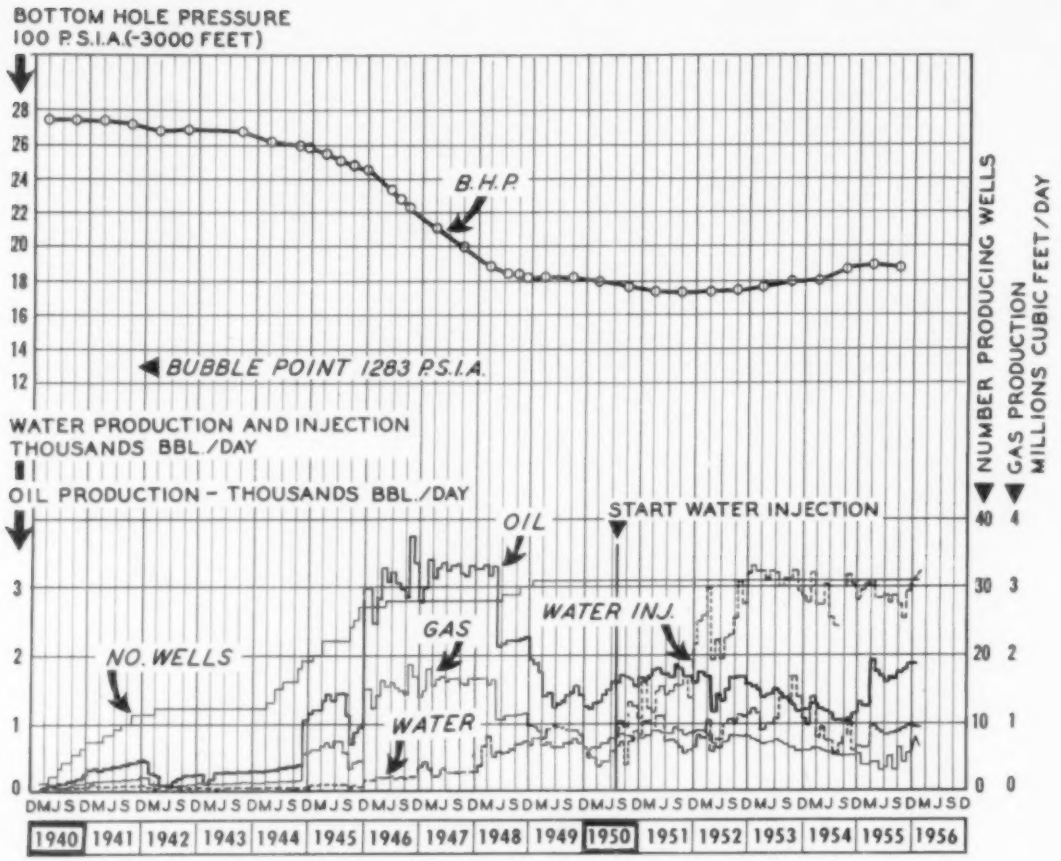
By Robert J. Enright
District Editor

ONE OF the country's unusual pressure-maintenance projects and at the same time a very effective one is that operating in Todd (Deep) crinoidal field of Crockett County, West Texas.

Here, water injection through a single input well has not only halted the decline in bottom-hole pressure but has steadily increased it.

It has hiked estimates of ultimate oil recovery from about 25 per cent before the flood to a current figure of about 40 per cent.

Dense impermeable zones in the crinoidal pay, which might normally



WATER INJECTION had an almost immediate effect on reservoir pressure and oil production. Fig. 3.

be expected to affect a flood adversely by fouling up the flood front, actually in this case seem to be causing no trouble and possibly may be of help.

Despite its oddities, the pressure-maintenance program in this field is getting satisfactory results.

History . . . Todd (Deep) crinoidal is located about 18 miles northwest of Ozona in north-central Crockett County.

It was discovered in April 1940 with the completion of Continental Oil Co.'s J. S. Todd Unit Block No. 2. The discovery came in at a total depth of 5,615 ft. for an initial potential of 840 bbl. of oil in 12½ hours.

Development was slow until a 6-in. pipeline outlet was completed in December 1944. By July 1949, 31 producing wells had been completed on 40-acre spacing—16 by Continental, 14 by Amerada Petroleum Corp. and 1 by Callery & Hurt.

The pool now has roughly 1,700 productive surface acres. The crinoidal reef has a gross pay thickness ranging from 0 to 400 ft. Average porosity is 11.7 per cent, average permeability about 13.6 md.

Geology . . . The crinoidal is a reef development of Lower Pennsylvanian age. Below it are Middle Ordovician (Simpson) sediments showing the presence of an unconformity. Mississippian, Devonian, and Silurian are missing.

The areal extent of the reef aquifer to the southwest has not been defined. Limited information indicates, however, that it does not extend more than a few miles in that direction. The reef pinches out along the east, north, and northwest edges of the field. Productive area of the remainder of the field is limited by a water-oil contact at roughly 3,430 ft. (see Fig 1).

The pool is an elongated dome-type structure. The dense zones within the reef are believed to be limestone deposited when conditions were not favorable for crinoid life.

Logs indicate that some of these zones are continuous into the formation surrounding the reef (as would be expected if they are a true depositional feature) and that three of them are continuous over a major portion of the reservoir.

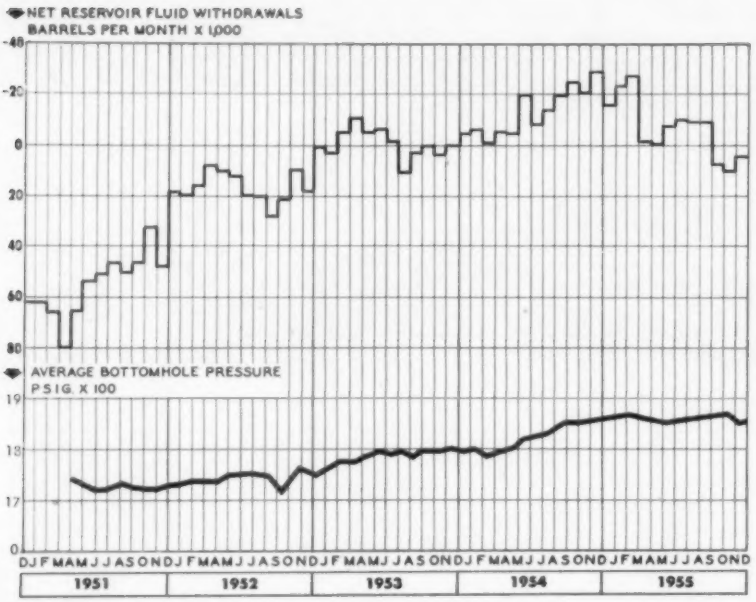
Pressure behavior . . . Original reservoir pressure was 2,743 psi., and saturation pressure was determined to be 1,283 psi. at 158° F. The crude is undersaturated. The original solution gas-oil ratio was 501:1.

Early studies of the pressure and production performance of the pool indicated that the main source of energy in the crinoidal was expansion of the reservoir oil. There is a very limited water influx from the southeast corner of the field, and no gas cap.

Rapid field development between 1944 and 1948 caused a noticeable pressure decline, and in 1948, an engineering committee was set up to look into the performance of the reservoir. The committee concluded that the limited water drive could be aided by a pressure-maintenance program. It was recommended that a unit be set up to do this.

The unit was formed, approved, and began operating January 1, 1950, with Continental Oil Co. as operator.

The unit converted its No. 1 well on Tract 13 into a water input well in June 1950 and began injection of produced water from the crinoidal and Ellenburger pays. Three other wells (No. 4, Tract 2; No. B-5, Tract


NET RESERVOIR FLUID WITHDRAWALS
BARRELS PER MONTH X 1,000
-40
-20
0
20
40
60
80
AVERAGE BOTTOMHOLE PRESSURE
P.S.I.G. X 100
19
18
17
0
D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
1951
1952
1953
1954
1955

RESERVOIR FLUID WITHDRAWALS have increased substantially over a 5-year period, as has bottom-hole pressure. Fig. 4.

9; and No. A-4, Track 11) were shut in for monthly observance of bottom-hole pressure.

Flood performance . . . Water injection had an almost immediate effect. (Fig. 3.)

By September 1951, the decline in reservoir pressure had been substantially stopped. Where the decline between semiannual pressure surveys had ranged from 24 to 30 psi., it suddenly dropped to 6 psi.

The lowest average pressure field-wide in the pool was 1,744 psi., recorded in March 1952. This was just 1 psi. below that obtained by the September 1951 survey. Since then pressure has been building up steadily, reaching a maximum of 1,874 psi. in September 1955 (see Fig. 2). The pressure was 1,852 psi. in March 1956.

A study of the recovery efficiency of the flood, carried out by the unit in January 1953, quickly showed how effective it has been.

Cumulative Production

Cumulative oil production to January 1, 1953, was 6,382,661 bbl. Using material-balance equations, the unit calculated that without the flood the production would have been only 1,816,033 bbl. The flood thus accounted for 4,566,628 bbl.

The unit believes that recovery due to water flood probably will be around 40 per cent.

As of September 1951, the reservoir had produced 5,620 bbl. of oil per each pound drop in pressure. Three years later, as of September 1954, this index had been hiked to 8,248 bbl. per pound drop.

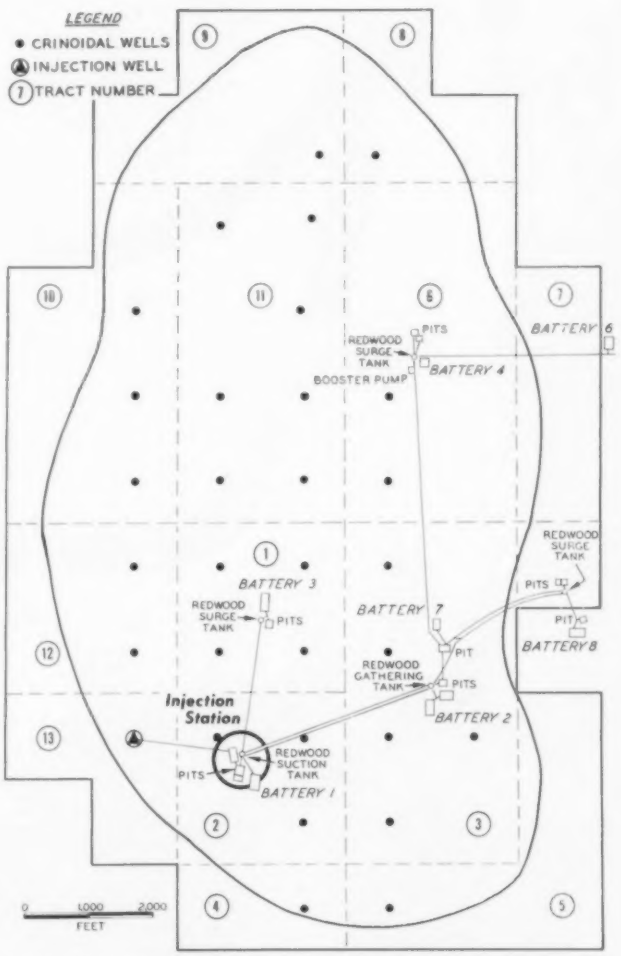
Reservoir fluid withdrawals are charted against pressure in Fig. 4.

M.E.R. of the field was boosted by the Texas Railroad Commission April 1, 1955, from the old figure of 2,295 to 3,500 bbl. daily.

Pressure uniform . . . The pressure buildup in the crinoidal due to water injection has been surprisingly uniform throughout the pool in spite of the dense limestone barriers.

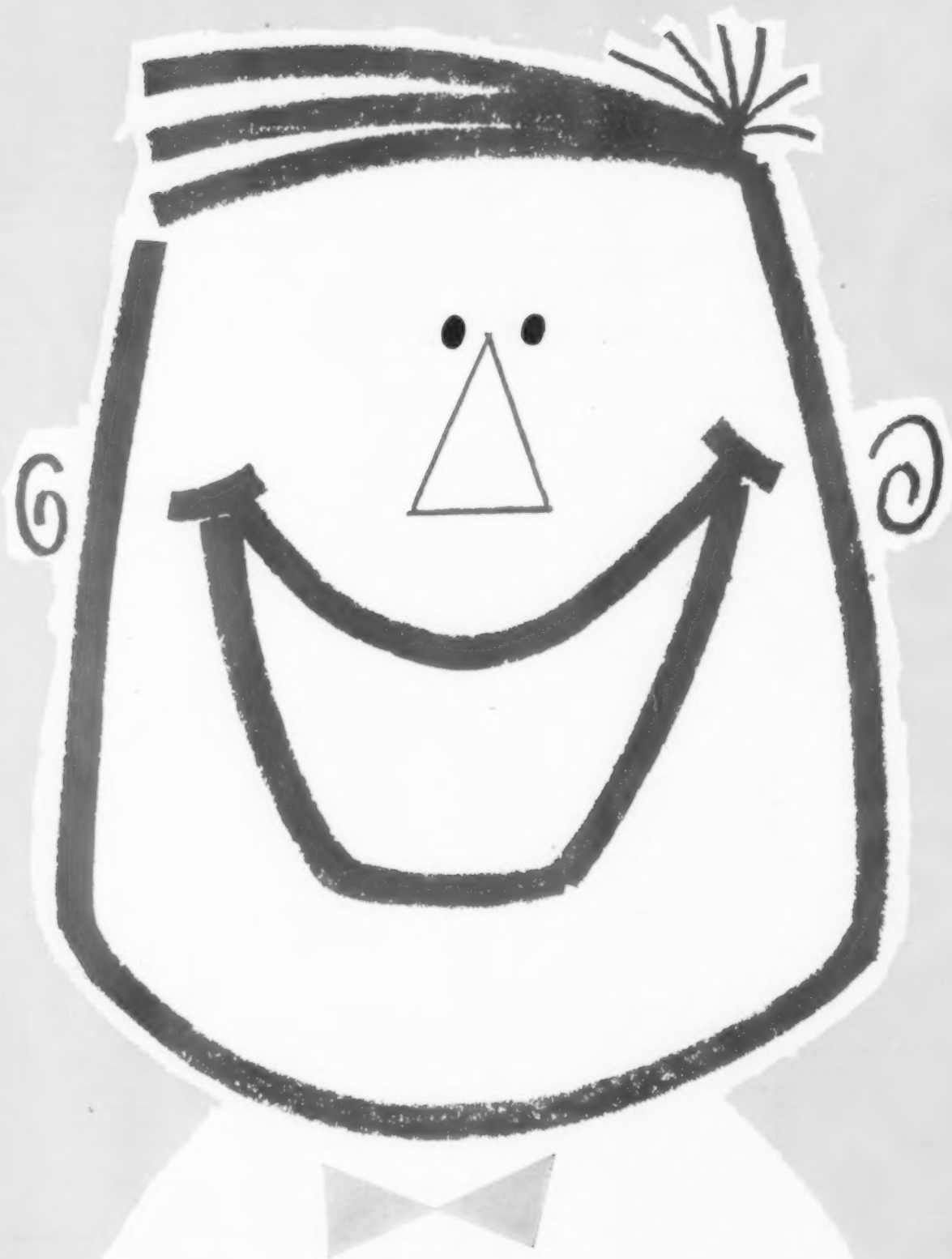
This proves that there is effective communication in a vertical direction around the bounds of the impermeable zones.

Three of these are continuous over a major part of the reservoir. The shallowest of the three prevents vertical fluid movement throughout a major portion of the field, but pinches out both in the northern and southern ends of the field to permit communication around it.



WATER HANDLING AND INJECTION system for the Todd crinoidal unit. Fig. 5.

delighted...



WITH HIS oilmaster DUAL ZONE PUMP

And why shouldn't he be? *It saved him the cost of drilling a second well.* But the most pleasant discovery he made was the ease with which the new **OILMASTER** tools are run, and the flexibility of operation they provide.

It is now possible with one pumping unit, one packer, and one string of rods to exercise every control on both of the zones that is possible in a single producer. And with the newly designed equipment, parallel strings are run and landed separately in landing heads built integrally with the cross-over shoe.

If you have not seen the newest designs in Dual Zone Production Equipment, call your Oilmaster Representative and prepare your face for a wide smile of pure delight when you see how simple it is to artifically lift two zones from one well bore.

oilmaster PUMPS FOREMOST IN THE INDUSTRY

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Export: The National Supply Co., Export Division,
600 Fifth Avenue, New York
Co-Distributors: Union Supply Company,
Beacon Supply Co., Industrial Supply Co.

INJECTION pump, 2,000-bbl. pump-suction tank, and water filters are located at field's No. 1 battery. Low-level shutoff switch in tank stops pump engine when fluid level in tank drops to 4 ft. Fig. 6.

The second zone permits communication only in the extreme southeast corner of the field.

The third and deepest zone presents a limited barrier since there is some communication around it within the field. Sections which should have been oil productive if this zone were continuous were found to bear water when wells were deepened and tested.

Point of injection . . . Water is being injected below the second limestone zone, while most of the oil production is produced from intervals above this zone. So far no water from the input well has shown up in the offsetting producers. And, contrary to what normally would be expected, pressure in the offsets is about the lowest in the field (Fig. 2).

This indicates that the injected water is in communication with the aquifer and is effectively repressuring the entire oil reservoir by detouring around the second dense zone somewhere in the reef beyond the oil-productive limits.

Wells in the southeast part of the field, where water is encroaching, produce water at higher elevations than those in the west or southwest. Encroaching water from the southeast has had to reach a sufficient elevation to cross the ridge formed by the second dense zone before it could encroach on the west side of the field.

Production . . . Average fieldwide water cut reached a high of 48 per cent in November 1954. Four big water producers were shut in in December 1954 and their allowables transferred to other wells in the unit. This reduced the water cut to 32 per cent immediately. It declined further during 1955 to average about 21.8 per cent for the year.

The unit now is injecting about 3,150 bbl. of water a day and producing 1,757 bbl. of oil, 431 bbl. of water, and 880 M.c.f. of gas daily. None of the gas is flared. There are now 11 wells producing water.

Cumulative oil production from the field is 8,346,617 bbl. The unit has injected a total of 5,440,941 bbl. of salt water into the crinoidal and has produced 3,720,927 bbl. of oil since injection began.

Surface facilities . . . Produced water from the crinoidal and Ellenburger pays is gathered at six tank batteries in the field (Fig. 5). Roughly 300 bbl. daily is obtained from crinoidal batteries on Tract 1 and 3, the remaining 2,850 bbl. from Todd (Deep) Ellenburger batteries Nos. 4, 6, 7, and 8.

Treaters discharge into 65-bbl. redwood surge tanks at the Ellenburger 4, 6, and 8 batteries and the crinoidal Tract 1 battery. These tanks are equipped with low-level float shutoffs and siphon overflow lines which draw off excess water to pits. An oil blanket on the water in these tanks prevents oxygen from contacting with the water.

Water from the four surge tanks and the remaining treaters flow through 2 and 3-in. lines to a 500-bbl. redwood gathering tank at battery No. 2. This tank likewise is equipped with siphon and low-level float-operated valve and an oil blanket is maintained.

The gathering tank empties through parallel 4 and 2-in. lines into a 2,000-bbl. redwood pump-suction tank at No. 1 battery (Fig. 6). The tank has a siphon and a mercury-type low-level shutoff switch which stops the engine on the injection pump when the fluid level in the tank drops to 4 ft.

Injection system . . . The injection pump is a triplex with a fluid end of manganese bronze. The liners are porcelain. This combination has proved highly successful in protecting against pump corrosion for the 3½ years that the pump has been in operation.

The injection pump takes water from the suction tank through a 6-in. meter run and manifold and discharges it to the injection well through a 2⅞-in. o.d. plastic-coated tubing line.

Water input volumes are measured by a mercury-type orifice meter between the suction tank and the pump. The meter is checked periodically against tank gages and has never been more than 0.7 per cent in error.

All salt-water lines prior to installation were coated internally with vinyl plastic. Failure of the vinyl-plastic coating and resulting pipe-wall corrosion recently forced the unit to replace some of the gathering lines with epoxy-coated pipe.

It currently is replacing the 3-in. from No. 4 battery to the gathering tank with 4-in. epoxy-coated line and the 4 and 2-in. lines from the gathering tank to the suction tank with 6-in. epoxy-coated line.

It also is replacing the 2⅞-in. line from the pump to the injection well with a 3½-in. o.d. line which will be plastic-coated in place. **End.**

New Vulkollan Cup Material Outlasts 12 Rubber Swab Cups

A NEW TYPE of material developed in Germany, called Vulkollan, is being shown to have much higher wear resistance than rubber when used as swab cups. In comparative tests, the Vulkollan swab cups have outlasted as many as 12 conventional rubber cups.

Because of its high tensile strength and abrasion resistance, swab cups made of the new material have no reinforcement or metal collars. Tensile strength is 8 times that of the strongest rubber and abrasion resistance is 30 times greater.

Performance . . . A particularly tough test for swabs was swabbing 5½-in. wrought-iron casing, run during a pipe shortage. Eight rings of the new material and four rings of rubber were installed on a swab. The well was 3,100 ft. deep and 200 ft. of fluid was swabbed each run of the tools.

After two trips, the rubber rings were worn and torn. They were removed and the Vulkollan rings continued swabbing for 31 trips. Even after this the rings showed little wear and no leaking.

In another swab test of new 5½-in. casing, the new material was tested against rubber in the form of Type G-W swab cups. The swab was pulled from 3,160 ft. 120 times, carrying 50 per cent oil and 50 per cent water. The upper cup of rubber wore out completely and became ineffective during the latter part of the test. The Vulkollan cup still held fluid with no appreciable leak back and was estimated to be 10 to 15 per cent worn out.

In other swabbing runs by cable-tool operators, the new type of swab cup saved having to change cups every 5 or 10 pulls. On two wells this amounted to a savings of $90 to $180. The same cups were used for both wells and were still serviceable.

Swab cups made of Vulkollan are being made in this country under license by Albert Trostel Packings, Ltd., Lake Geneva, Wis.

VULKOLLAN, a new material developed in Germany, has a high tensile strength and abrasion resistance.

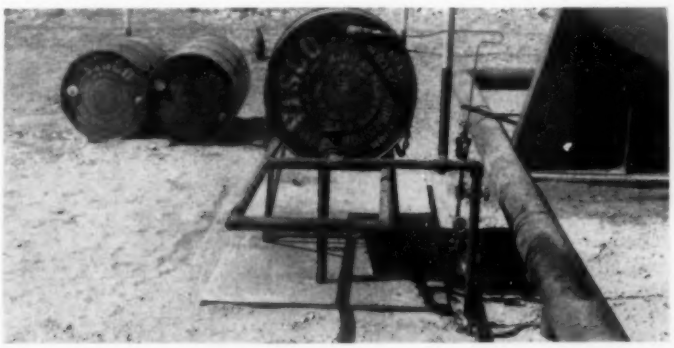
MONEY-SAVING foundations such as this one are especially useful in water-flood operations.

Single Foundation Unit Fits All Pump Sizes

A WEST TEXAS water-flood operator has taken care of the expense of making foundations for pumping units. This company makes a single concrete foundation that will fit all sizes of pumping units needed in the area.

The secret is making a T-slot in the foundation. Then, the unit bolts to the foundation with T-headed bolts. Moreover, this arrangement makes it easy to mount a unit and adjust it for distance from the wellhead.

This universal foundation is especially money saving in water-flood production where pumping units must be changed often to take care of increasing fluid production.



FOREIGN MATTER is prevented from entering this emulsion breaker.

Pressure System Eliminates Dust, Dirt

IN MANY areas, it is a big problem to keep dust and dirt out of the chemical used to break oil-water emulsions. If a bucket is used to haul emulsion breaker from drum to pump, the bucket will accumulate a dust coating rapidly.

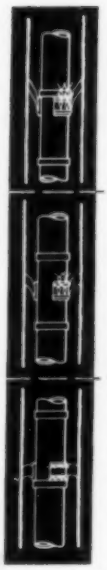
To overcome this, F. R. (Jake) Whitefield, of The Texas Co., Monahans, Tex., built a pressure system to force chemical out of the drum and into the pump's reservoir.

A line runs from the lower outlet

HERE'S WHAT BAKER

Controlled SCRATCHING

CAN DO FOR YOU!



When running in the casing string . . . the scratcher wires pass readily through sections which are *not* to be cemented, without damaging the vital filter cake.

When lifting the casing out of the slips . . . the scratcher wires do not attack the mud cake because the entire scratcher assembly remains stationary due to the three-foot interval between stop rings.

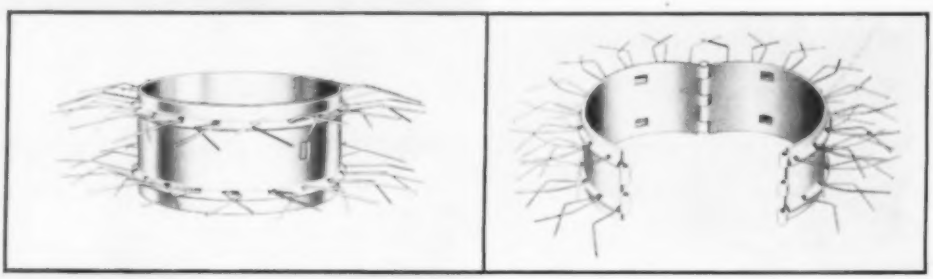
Only when the "scratching operation" is begun . . . by raising the casing a distance greater than the spacing between the stop rings, do the scratcher wires open outward and start to remove the mud cake.

Down view shows scratcher wires in running-in position.

BAKER "Controlled Scratching" means effective removal of the mud cake, but ONLY in the areas to be cemented, where the original formation is exposed for better bonding of the cement.—The expensive filter cake—vital to the successful completion of your wells—is left virtually undisturbed in ALL areas outside of the cementing area. The strong "double-shell" construction, and the "fold-back" wires permit the scratchers to arrive *at the cementing point* in *good operating condition*, and then the overlapping wires effectively remove the mud cake over the 360-degree surface of the well bore.

Available with 4½-inch long (C-45) scratcher wires, or 2½-inch long (C-25) wires, one exactly right for your specific casing program. Contact the Baker representative in your area for helpful recommendations.

Baker Model "C" SOLID RING Wall Scratchers, Product No. 901-C, are merely slipped over the casing and positioned between two properly spaced stop rings



Baker Model "C" HINGE-LOK Wall Scratchers, Product No. 900-C, are closed around the casing and the hinge is locked with a special knurled closing pin.

BAKER | **WALL SCRATCHERS**

BAKER OIL TOOLS, INC. HOUSTON • LOS ANGELES • NEW YORK

of the drum to the chemical pump (out of sight in the foreground). Into the top of the drum, Whitefield has tied a gas line which keeps about 2 psi. on the drum and can force chemical to the pump through the line.

Since the gas and chemical lines are broken only when the chemical drum is changed, there's no chance for dust or dirt to contaminate the chemical.

OLD SPUDDER rigged with telescoping mast is converted to rotary rig.

H. W. SITTON, driller, starts wire-line core barrel into drill pipe.

GEARS and chains connect sand-line drum, drilling-line drum, and cat head.

Steel-Reinforced Spudder Is Converted To Rotary for Shallow Core Drilling

AN OLD Fort Worth spudder was rigged up as a rotary by Combination Drilling Co., of Corsicana, Tex., recently to take cores in shallow sands around the Corsicana area. H. W. Sitton, driller and coowner, is shown with the rig on location at the north edge of Angus field.

Sitton took out all wood on the spudder and replaced it with steel beams. Then he installed Wilson drums on the Fort Worth clutch to use a ¾-in. drilling line on the rotary hookup. With 3½-in. drill pipe, he can cut a $^{5}/_{16}$-in. core and drill to 3,000 ft. which is sufficient for that area.

Winch-Line Raises and Lowers Derrickman

THE DERRICKMAN on Ohio Oil Co.'s big rig operating in southern Oklahoma gets help when he goes up the derrick ladder. In fact, climbing is easy with the lift given by a hydraulic winch. And it is much safer.

As the derrickman climbs, he rests in a saddle attached to a winch line. The line passes over a pulley in the top of the mast from a hydraulic winch placed on the ground. The winch pulls the man upward slowly with little effort on his part and with little chance of his falling.

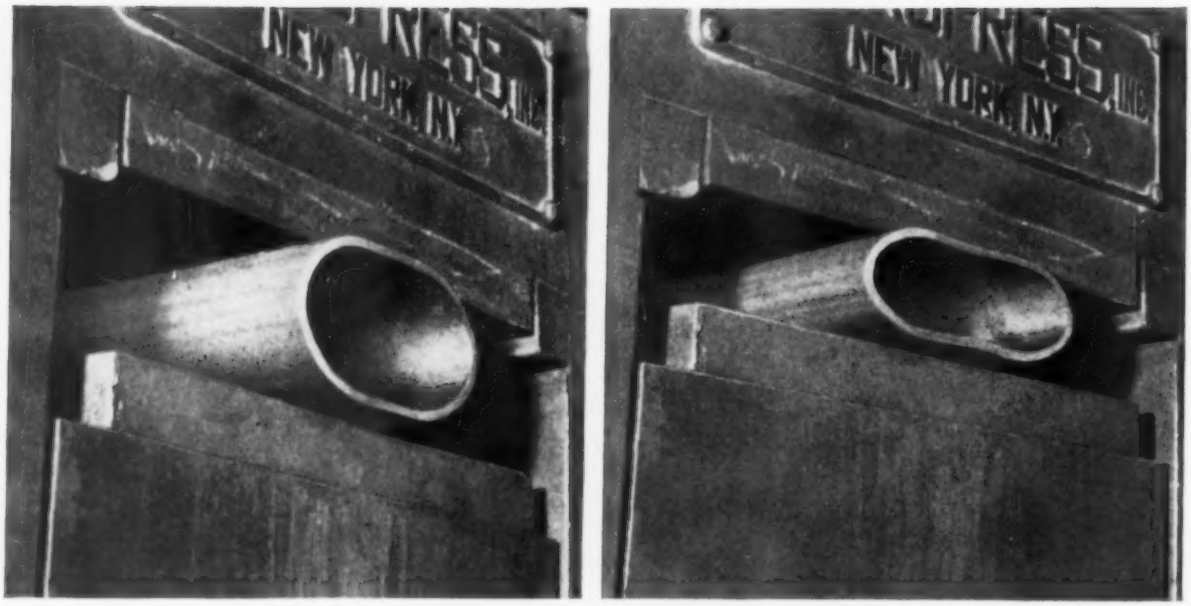
Air-Operated Winches Reduce Trip Time

ON SOME drilling rigs the derrickman uses air-operated winches to aid him in handling heavy drill collars. Use of these pullbacks has cut round-trip time by 10 minutes per trip. With rig time costing $1,000 per day, these pullbacks will pay out in less than 3 months.

The air-operated winches are used to pull the drill-collar stands back behind the drill-collar finger when coming out of the hole and to position the stands for engagement with the elevators when going in the hole.

A horizontal I-beam track behind the derrickman's platform supports the single-drum air hoist used. The hoist may be slid along this track and locked in any one of a number of holes provided at 1-ft. intervals.

DUCTILITY



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We measure our pipe's strength and ductility. We inspect it thoroughly for roundness... concentricity... accuracy of dimension.

Thus, when you specify electric weld pipe from Kaiser Steel, you can be *certain*. Certain of performance to match your most exacting demands. Certain, too, of service when and where you need it.

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Storage Stability

How Storage Affects Blended Fuels

By F. G. Schwartz and C. C. Ward

IN addition to the samples stored at the six conditions listed, a duplicate set was water-washed before storage. Some operators claim that water washing improves stability. For each fuel a water-washed sample and a control sample were treated before storage as follows:

- **Control sample**—A 400-ml. sample of the fuel was stored in a vented glass bottle.

- **Water-washed sample**—A 400-ml. sample of the fuel was shaken vigorously with three portions of distilled water and then stored in a vented glass bottle.

Authors are with Petroleum Experiment Station, Bureau of Mines, U.S.D.I., Bartlesville, Okla.

A comparison of the gum values for the two samples in each set indicates water washing did not improve the stability of any studied.

Blended Fuels

Storage in contact with copper, with or without sea water, was the most severe condition, and blends reacted according to the type of fuel in the blend. Those containing thermal-cracked fuel showed the most response to copper catalysis of gum formation.

Some blends showed excessive gum formation when stored in contact with galvanized iron and sea water. Usually at this condition most of the gum formed during the later periods of storage.

The relative severity of the storage conditions for blends is compared in the list below, arranged in order of increasing severity:

1. Storage with no contaminants.
2. Storage in contact with iron.
3. Storage in contact with iron and tap water.
4. Storage in contact with galvanized iron and sea water.
5. Storage in contact with copper.
6. Storage in contact with copper and sea water.

TABLE 2—DATA FROM 110° F. STORAGE OF 34 DISTILLATE FUELS

(Fuel plus no contaminant)

Sample No.	Fuel description—	Light transmission, per cent, weeks storage					Insoluble gum, mg. per 100 ml., weeks storage					Soluble gum, mg. per 100 ml., weeks storage		
		0	6	13	26	39	0	6	13	26	39	0	13	39
	Straightrun:													
101	W. Mid-Continent	99.5	98.9	98.8	96.0	93.9	0.1	0.2	0.2	0.5	0.5	1.3	1.6	2.4
108	E. Mid-Continent	87.1	80.5	76.5	72.2	63.9	.7	.7	.8	2.0	2.0	3.4	6.0	6.8
113	Gulf Coast	98.8	98.7	95.0	97.8	89.3	.4	.7	.3	.3	.3	nil	2.6	2.4
118	W. Texas	95.4	93.2	92.5	86.2	84.1	.5	.3	.4	.8	.4	1.7	3.2	3.4
123	California (1)	38.4	20.5	17.9	15.5	10.5	.9	.6	.7	1.3	1.6	6.9	14.6	28.2
124	California (2)	34.6	17.4	13.3	11.6	7.7	1.0	.8	1.1	1.1	1.6	6.6	18.0	29.8
132	Rocky Mountain	98.0	97.7	97.6	97.3	91.7	.3	.4	.5	.4	.9	1.0	2.4	2.8
137	Scurry County, Texas	99.5	97.9	90.0	85.9	87.7	.4	.9	1.3	1.9	6.0	nil	.6	3.4
140	Middle East	99.3	99.4	99.2	87.3	92.1	.2	.4	.7	.5	.8	.6	.4	1.2
143	Venezuelan	87.2	67.6	58.7	52.6	41.7	.5	.2	.6	3.1	1.4	1.8	2.8	9.4
146	Mexican (1)	45.9	60.9	66.5	50.0	39.6	.7	.7	.8	.5	.6	10.9	13.0	17.4
167	Mexican (2)	82.1	90.1	89.3	90.1	77.8	.5	.5	.5	.4	.1	5.5	4.0	5.4
168	Canadian	98.9	91.0	84.5	79.6	69.8	.9	.6	.5	.7	.3	1.6	1.4	2.8
	Thermally cracked:													
102	W. Mid-Continent	85.5	21.2	22.5	23.8	23.8	.2	.4	.7	1.0	1.3	2.9	17.0	32.6
109	E. Mid-Continent	63.0	24.4	19.8	18.0	15.5	.3	.7	1.4	1.5	2.4	1.4	6.6	18.6
114	Gulf Coast	62.6	31.3	38.3	46.8	48.4	.3	1.1	2.6	14.0	51.3	1.8	31.2	259.2
119	W. Texas	43.2	35.0	32.4	29.9	31.8	.3	5.5	10.5	24.0	48.1	16.2	112.6	326.0
125	California (1)	25.2	<3	<3	<3	<3	.3	10.8	17.1	29.4	37.7	1.9	126.0	167.2
126	California (2)	<3	<3	<3	<3	<3	.7	28.3	49.3	93.3	127.7	19.4	414.0	597.8
133	Rocky Mountain	71.3	16.7	10.3	12.4	10.8	.1	.7	1.1	2.2	3.2	2.9	19.6	49.4
169	Canadian	69.3	3.0	6.4	15.5	6.5	.4	1.5	5.3	8.5	9.6	3.3	23.8	41.4
192	Mexican	81.8	74.9	72.3	65.5	58.0	.4	1.9	4.3	6.9	10.3	4.1	12.8	42.6
	Catalytically cracked:													
103	W. Mid-Continent (1)	85.6	35.1	27.7	22.2	16.0	.2	1.2	2.7	5.4	6.1	1.6	10.8	26.8
104	W. Mid-Continent (2)	96.7	36.1	34.0	32.1	27.3	.1	2.7	4.1	6.2	5.8	1.6	17.6	18.0
110	E. Mid-Continent	93.4	85.6	68.8	57.5	49.8	.2	1.1	3.5	5.8	7.5	3.3	10.6	16.6
115	Gulf Coast	97.6	95.0	85.4	66.2	53.6	.1	.3	.9	2.3	1.8	nil	3.8	9.6
120	W. Texas	93.4	66.3	44.6	26.6	23.1	.5	1.0	2.1	5.0	7.0	2.5	21.4	44.4
127	California (1)	65.9	18.6	9.7	4.5	<3	.7	1.1	1.6	2.7	2.1	10.6	48.0	74.8
175	California (2)	42.9	3.5	.9	<3	<3	1.0	2.3	4.2	7.1	9.6	6.5	53.4	97.4
134	Rocky Mountain	92.0	42.5	14.9	11.3	7.9	.1	1.7	13.2	17.1	18.6	1.0	46.2	68.0
138	Scurry County, Texas	83.9	28.2	18.7	17.8	4.5	.2	3.1	8.2	11.8	15.6	5.5	30.2	35.8
141	Middle East	94.2	37.1	32.9	44.1	26.6	.1	7.6	12.1	17.4	18.1	2.3	13.2	26.4
144	Venezuelan	80.8	12.5	6.2	1.7	<3	.5	3.7	10.4	16.6	15.7	3.3	74.0	81.0
170	Canadian	48.6	18.7	11.5	9.1	4.0	3.3	1.8	3.8	7.7	7.4	7.9	39.4	61.4

NONAGON

...a new word in refinery design

Geometrically a 9-sided figure, the nonagon has provided a basis for structural design of the world's largest Thermofor Catalytic Cracking Unit. The problem of fitting together most effectively and most economically the complex processing equipment comprising Magnolia Petroleum Company's newest Catalytic Cracking Unit was solved by designing a 9-sided structure.

This unit, which has added 28,000 barrels per day to the catalytic cracking capacity of Magnolia's Beaumont Refinery, is but part of a major expansion and modernization program which also includes a Catalytic Reforming Unit, the revamping of one of its existing TCC Units and of other existing plants. Its completion and operation not only enlarges the Beaumont refinery but ensures flexibility with which to meet increasingly stringent product specifications.

Engineering, procurement and construction of the program was another Bechtel turnkey responsibility.

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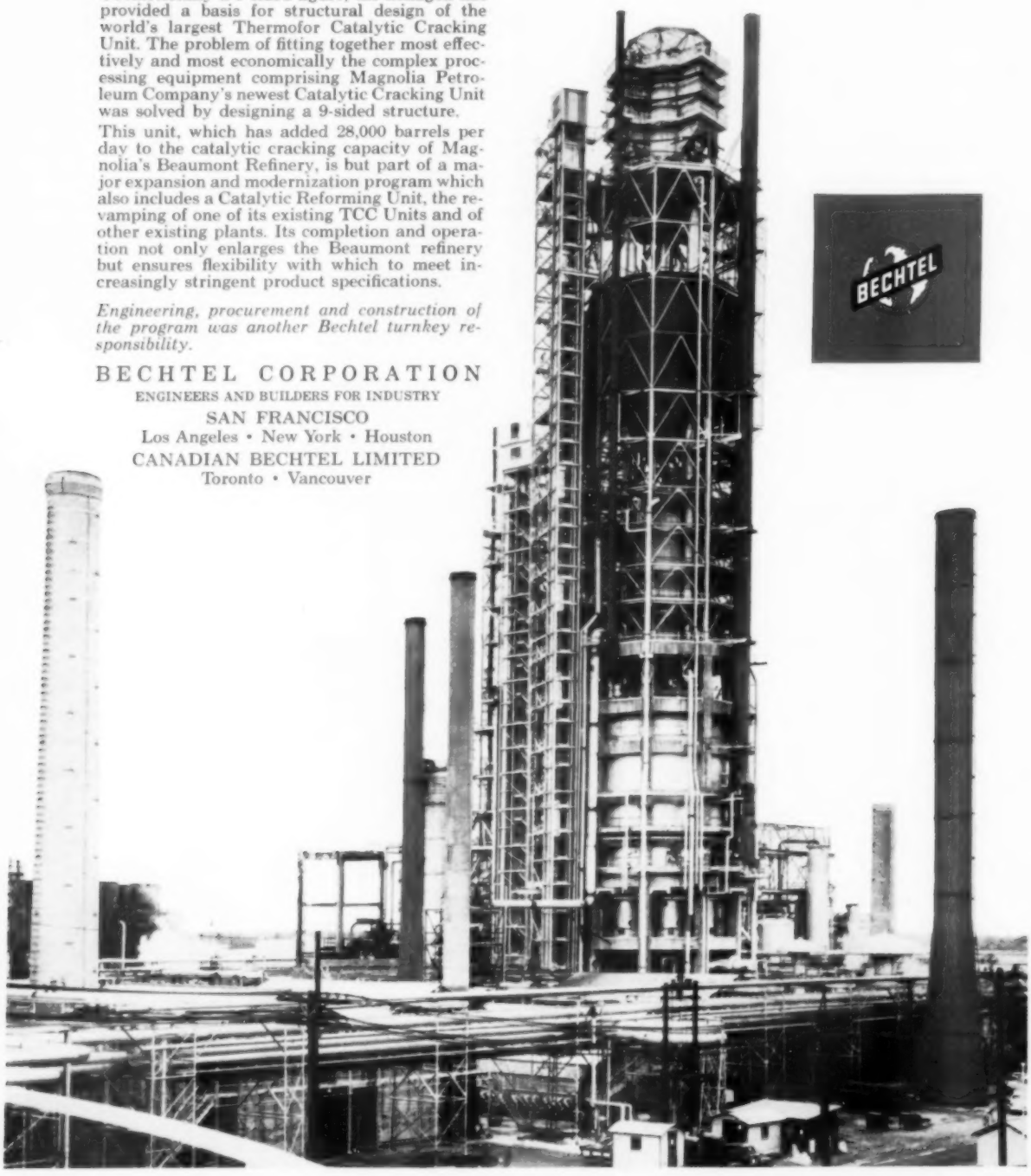

By W. L. Nelson
Technical Editor

COST-imating

35. What Is Effect of Size on Cost?

LARGE-CAPACITY plants or equipments are cheaper than small equipments if compared on a basis of cost per unit of capacity. Thus, a 1,750-sq. ft. exchanger costs only about $4.00 per sq. ft. (1955), whereas a 250-sq. ft. exchanger costs about $8.50. The ratio of total costs is:

$$\frac{1{,}750 \times 4.00}{250 \times 8.50} = \frac{\$7{,}000}{\$2{,}125} = 3.29$$

The capacity of the larger unit is 7 times that of the smaller unit but the cost ratio is only 3.29 times. For a capacity ratio of 7.0, Table 1 indicates a price ratio of 3.22 (rather than 3.29) for equipments that follow the so-called six-tenths power rule. Mathematically, this rule simply states:

$$(\text{Cost}_A/\text{Cost}_B) = (\text{Capacity}_A/\text{Capacity}_B)^{0.6}$$

or for the above exchanger:

$$3.29 = (7)^{0.611}$$

Had the six-tenths rule worked perfectly, the exponent would have been 0.6 rather than 0.611.

Fig. 1 indicates how the cost of a few plants varies with capacity. The dashed lines represent plants or equipments whose cost curves have an exponent or slope of 1.0.

The six-tenths rule[1-4] works surprisingly well for many equipments such as tanks, vessels, pumps, towers, evaporators, exchangers, pipelines, furnaces, filters, etc., and even many plant installations. It applies particularly well to a series of equipment or plants that are offered or designed by a single company. However, the actual installed cost of plants as disclosed in the news literature indicates exponents or factors approaching 0.8 rather than 0.6. This is possibly due to the fact that large plants are often tailored for the particular job whereas smaller plants may tend to be package-type plants. This is particularly evident with catalytic polymerization plants (COST-imating No. 26, March 11, 1957) as shown in Fig. 1. Most smaller plants are installed by one licensor whereas larger plants are somewhat tailored for each job. Many of the lines of COST-imating 26-29 should consist of two lines, particularly the lines for complete refineries.

Also a unit may become impossibly large, and accordingly at larger capacities either duplication is practiced or a new type of plant must be adopted. Finally, the large companies that install large units tend to have larger overhead costs and to spend less effectively, and at the same time the large refiners tend to require more elaborate equipment. All of these factors tend to raise the average cost of large plants towards exponents of 0.75-0.8 rather than 0.6. Exponents for the 48 types of plants published in COST-imating No. 26-29 range from 0.39 to 1.0 and the average is 0.79 (also see Reference 5 which shows exponents for at least 100 equipments).

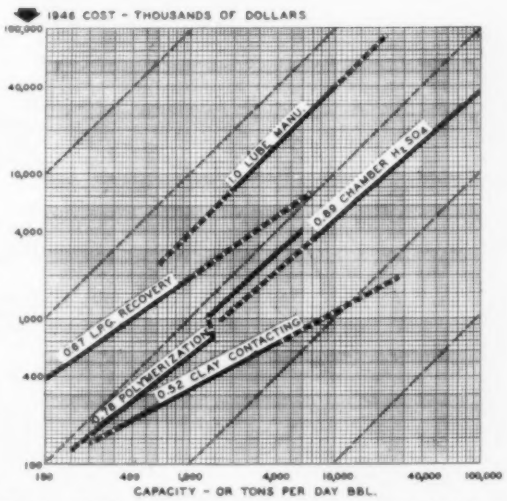

Fig. 1—Check of the six-tenths-capacity rule. (Dashed lines indicate no saving in cost with increased capacity.) The exponent is shown on each curve.

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1. Williams, R., Chem. Eng., Dec. 1947, p. 124.
2. Chilton, C. H., Chem. Eng., June 1949, p. 97.
3. Chilton, C. H., Chem. Eng., April 1950, p. 112.
4. Sherwood, P. W., The Oil and Gas Journal, March 9, 1950, p. 81.
5. Nelson, W. L. (Cost Versus Size), The Oil and Gas Journal, Oct. 5, 1950, p. 263.

TABLE 1—MULTIPLY COST OF SMALL PLANT BY THESE FACTORS TO OBTAIN COST OF A LARGER PLANT.*

Ratio of capacity, larger over smaller	Multiplier factor*	Ratio of capacity, larger over smaller	Multiplier factor*	Ratio of capacity, larger over smaller	Multiplier factor*
x	$x^{0.6}$	x	$x^{0.6}$	x	$x^{0.6}$
1.0	1.00	3.0	1.93	7.0	3.22
1.1	1.06	3.2	2.01	7.5	3.35
1.2	1.11	3.4	2.09		
1.3	1.15	3.6	2.16	8.0	3.48
1.4	1.22	3.8	2.23	8.5	3.61
1.5	1.28				
1.6	1.33	4.0	2.30	9.0	3.74
1.7	1.37	4.2	2.37	9.5	3.86
1.8	1.42	4.4	2.43		
1.9	1.47	4.6	2.50		
		4.8	2.57	10.0	3.98
2.0	1.52			10.5	4.10
2.1	1.56	5.0	2.63		
2.2	1.61	5.2	2.69	11.0	4.21
2.3	1.65	5.4	2.75	12.0	4.43
2.4	1.69	5.6	2.81	13.0	4.66
2.5	1.73	5.8	2.87	14.0	4.87
2.6	1.77			15.0	5.07
2.7	1.81	6.0	2.93	16.0	5.27
2.8	1.85	6.2	2.98	17.0	5.47
2.9	1.89	6.4	3.04	18.0	5.66
		6.6	3.10	20.0	6.03
3.0	1.93	6.8	3.16	24.0	6.72

*For plants that follow the six-tenths rule.

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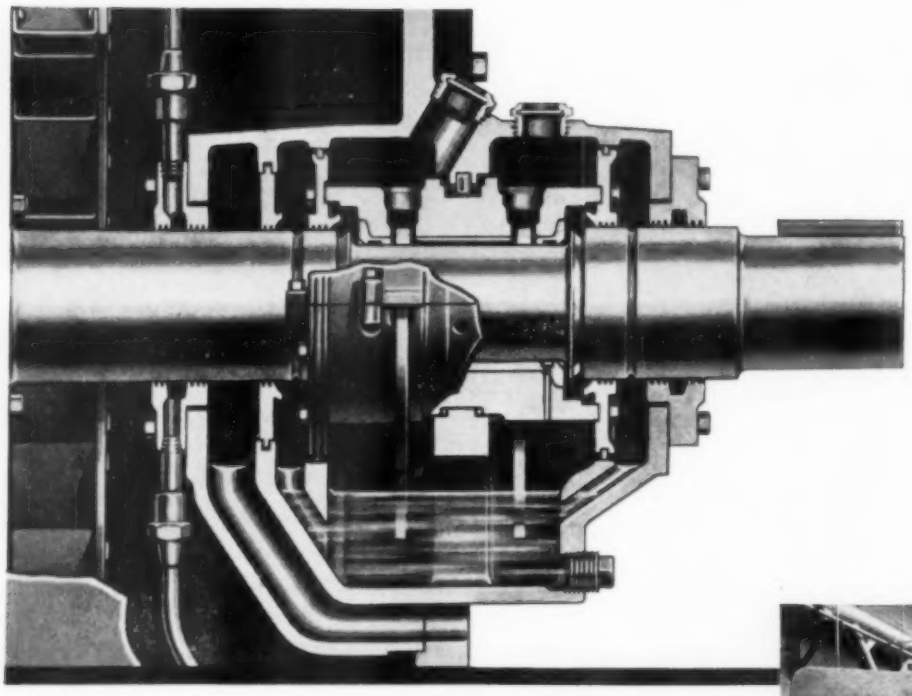

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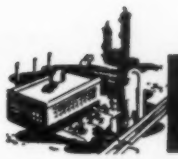


JOB IMPROVEMENT FOR THE PROCESS FOREMAN—97

What Is the Purpose of a Cooling Tower?

THE purpose of a cooling tower is to provide cool water at a certain temperature. The water used in a cooling tower is cooled by evaporation and is reused many times. A cooling tower has several advantages over well water or river water.

1. Corrosion and scaling of refinery cooling equipment is not as severe as with untreated river or well water.

2. Cost of water is comparatively low since it is reused many times.

3. The large lines, pumps, and sewers used to transfer water from the river to a unit and then back to the river would be very expensive.

Laws governing refrigeration or cooling . . .

1. Fluids require heat to change from a liquid state to a gaseous state and give up heat in changing from a gas to a liquid. (When water is vaporized the liquid is cooled).

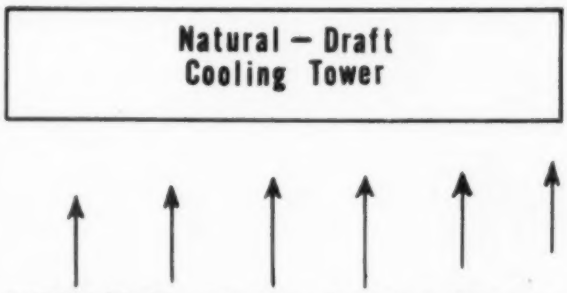
2. The temperature at which a change of state occurs is constant during the change, but this temperature will vary with the pressure. (Increase in pressure requires increase in temperature to change water to vapor).

3. Heat always will flow from a body at a higher temperature to a body at a lower temperature.

These three laws govern the process whereby cooling towers operate. You will recall that the flow of heat may be accomplished by conduction, convection, and radiation.

A large factor that has a decided effect on the cooling-tower operation is the process of evaporation. Evaporation is taking place all around us continuously. Water or any liquid, if left open to the air, disappears. Some liquids evaporate more rapidly than others (volatility). Alcohol evaporates more readily than water, while ether evaporates more rapidly than alcohol, etc.

Material taken from process-training-program manual, Baton Rouge, La., refinery of Esso-Standard Oil Co.



NATURAL-DRAFT cooling towers should be located in open areas. Arrows indicate direction of wind which should travel at least 1 m.p.h. Fig. 4.

Evaporation of water in air occurs at all temperatures, provided the air is not already saturated with water vapor. The air becomes saturated when it becomes so full of the molecules of the liquid that no more can enter it conveniently. For this reason, a liquid will evaporate more readily into dry air than into moist air. Hence, the higher the humidity (the higher percentage of water in the air) the less the evaporation.

If a light hydrocarbon is spilled on one's hands and evaporates, it makes the hands cold. In any liquid, if evaporation is taking place, the remaining liquid and nearby bodies are cooled. If a thermometer bulb is wrapped in cotton and ether is dropped on the cotton, the temperature on the thermometer will drop, due to the rapid evaporation of the ether.

This process in cooling water systems is important and the laws of evaporation are reviewed here:

1. Evaporation increases as temperature increases.

2. Evaporation increases with the extent of exposed surface.

3. Evaporation is much greater in dry air than in air-containing vapor.

4. Evaporation increases as the vapor is removed from the surface of the liquid.

5. The rate of evaporation is determined by the pressure on the exposed surface. (In this case atmospheric pressure is the pressure on the exposed surface).

Types of cooling towers . . . In thinking of cooling towers, we think of one of the following three types: (1) natural - draft, (2) forced - draft, and (3) induced-draft.

A natural-draft cooling tower, often called the atmospheric or open type, is one in which the air movement through the tower is dependent only upon atmospheric conditions. The sides are lowered and necessary air is supplied through the open base and through the louvered sides by natural air currents. This type of tower consists of a wooden or steel frame 20 to 60 ft. high although 35 ft. is the average. They are 8 to 18 ft. wide but usually average about 12 ft. and are as long as 2,000 ft. or more. They also contain a spray-nozzle system, equipment with horizontal wooden latticework, and decks at regular intervals from top to bottom to distribute water flow.

These structures should be located in an open area and in such a way that the wind will blow through the shortest part of the tower. Wind velocities should be at least 1 m.p.h. or more and preferably, 3 to 5 m.p.h. to give good results.

By Robert L. McIntire
The Datics Corp.

Using Electronic Computers in the Oil Industry

Part 15

Solving L.P.G. Shipping Problems

MATHEMATICIANS have developed a new tool in the series of tools which make up the management sciences. The particular method which is the subject of this article is the so-called "transportation problem."

Let us consider that we have four locations which are warehouses for liquid petroleum gases. From these points we wish to ship L.P.G. to six different locations. We know the freight rates between each origin and each destination and we wish to minimize our costs. This problem, as just stated, is a frequently arising problem in the petroleum industry. Since shipping costs for L.P.G. are a large fraction of the total costs, the optimum solution is of great importance.

Mathematicians will restate the problem in algebraic terms which can be adapted to solution on automatic computers:

"Find an m x n array of numbers x_{ij}, $i = 1, 2, \ldots m$ and $j = 1, 2, \ldots n$ such as $\Sigma_{i,j}\, c_{ij}\, x_{ij}$ is a minimum subject to the constraints that:

$$\Sigma_j\, x_{ij} = a_i \qquad (1)$$

$$\Sigma_i\, x_{ij} = b_j \qquad (2)$$

$$x_{ij} \geq 0 \qquad (3)$$

$$a_i \geq 0, \text{ integers} \qquad (4)$$

$$b_j \geq 0, \text{ integers} \qquad (5)$$

$$c_{ij} \geq 0 \qquad (6)$$

$$\Sigma a_i = \Sigma b_j \qquad (7)$$

This forbidding set of relationships can be reinterpreted.

The m x n array is the shipping table desired showing the quantities to be shipped from each origin to each destination. This table, as would be expected, will contain many zeros.

In our case of four origins and six destinations, m equals 4 and n equals 6. The c values are the costs per unit of L.P.G. shipped. The total cost is to be minimized.

Equations 1, 2, and 7 are simply material-balance equations. Equation 3 is a mathematical expedient necessary to eliminate the arithmetic possibility of shipping L.P.G. from a destination to an origin (remember . . . machines can't think). Equations 4, 5, and 6 perform a similar function and help eliminate answers absurd from an engineering viewpoint.

TABLE 1—UNIT COSTS

	Kansas City	Chicago	Lima	Shreveport	Miami	Port Arthur
Topeka	5	3	7	3	8	5
Borger	5	6	12	5	7	11
Houston	2	8	3	4	8	2
Tulsa	9	6	10	5	10	9

TABLE 2—L.P.G. SHIPPING SCHEDULE

	Kansas City	Chicago	Lima	Shreveport	Miami	Port Arthur
Topeka	0	1	0	0	0	2
Borger	3	0	0	0	1	0
Houston	0	0	2	0	0	0
Tulsa	0	2	4	2	0	0

Let us return to our specific example using small numbers to illustrate the results. Our example warehouses are producing points as follows:

(a) Topeka produces 3 million gallons.

(b) Borger produces 4 million gallons.

(c) Houston produces 2 million gallons.

(d) Tulsa produces 8 million gallons.

Total production—17 million gallons.

During the same time interval, our customers demand the following amounts of L.P.G.:

(a) Kansas City wants 3 million gallons.

(b) Chicago wants 3 million gallons.

(c) Lima wants 6 million gallons.

(d) Shreveport wants 2 million gallons.

(e) Miami wants 1 million gallons.

(f) Port Arthur wants 2 million gallons.

The cost of shipping is given in Table 1.

These costs may reflect company policies as well as actual dollars and cents. For example, we may arbitrarily have increased the cost of shipping from Borger to Lima just to avoid using (if possible) a certain truck line. Conversely, we may consider good will between Houston and Kansas City to be very important—and we can lower this cost figure.

The important conclusion is that this mathematics—coupled with electronics and computers—is a means of determining the real cost of such policies. Now, for the first time, we can investigate these decisions and evaluate them quantitatively.

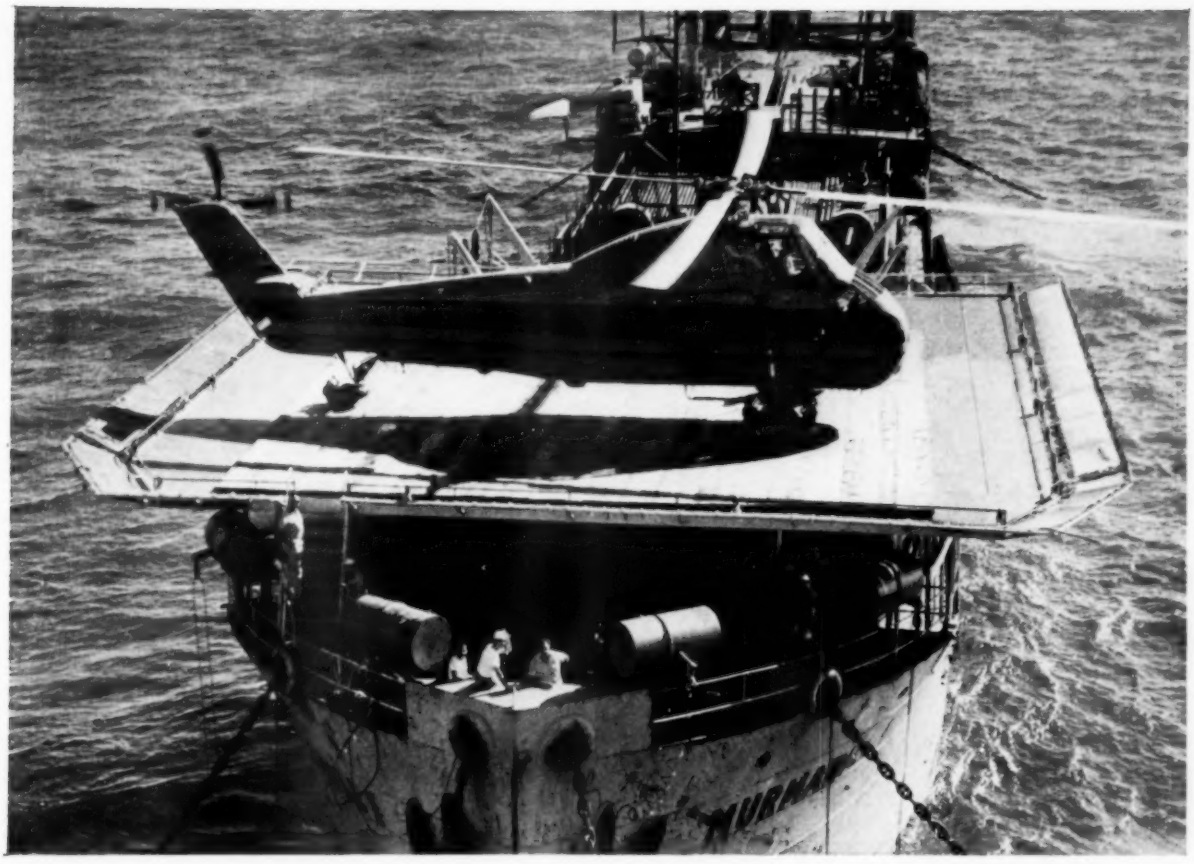
The computer will require only a few minutes to solve this problem. The final shipping schedule is given in Table 2.

You can check to see that this array is in material balance and that the total cost is 103. The contortions through which the computer goes to arrive at this answer are given amply in many different references. The important note is that, in no way can this shipping table be changed to lower the total cost.

This tool is receiving more attention each day by petroleum refiners.

References

1. Management Science, 3, 1, 1956, p. 24.
2. Journal of Math. and Physics, 20, 1941, pp. 224 ff.
3. Cowles Commission Monograph 13, 1951.



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HOW BELL SYSTEM COMMUNICATIONS SERVE THE PIPELINE INDUSTRY

CARROLL V. KROEGER, *distribution engineer, Washington Natural Gas Company, Seattle, Wash.*

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Pipeline Patrol

...Report on Construction

PIPELINE activity reported here is compiled from surveys conducted by The Oil and Gas Journal among pipeline companies and contracting firms. Projects listed include those proposed, contracted, and under way.

U.S. Crude-Oil Pipelines

• **Cape Pipe Line Co.** (Sun Oil Co., Cities Service Co., Atlantic Refining Co.)
Project: Line from lower Delaware Bay to Philadelphia.
Status: Long range plans.
Completion: 1960

• **C.A.T.C.** (Continental Oil Co., Atlantic Refining Co., Tidewater Oil Co., Cities Service Production Corp.)
Project: 19 miles of 12-in. from Grand Isle, La., to Platform A in Block 47 field in Gulf of Mexico, plus four 5-mile sections of 8-in. to three other platforms in Block 47 and one in Block 40.
Status: Under way.
Contractor: **Marine Gathering Corp.**
Completion: September 1, 1957.

• **Four-Corners Pipe Line Co.** (Shell Oil Co., Standard Oil Co. of California, Continental Pipe Line Co., Gulf Oil Corp., Richfield Oil Corp., Superior Oil Co.)
Project: 635 miles of 16-in. from Aneth field in southern Utah to Los Angeles, 86 miles of 12-in. from New Mexico's Bisti field to Red Mesa station 35 miles southeast of Bluff, Utah, and 3 miles of 6, 8, 10-in. feeder lines from other fields in New Mexico and Utah. Line will be operated by Shell Pipe Line Corp. as agent for the companies.
Status: Under way.
Contractor: **A. P. Vaughn Construction Co.,** Fort Worth, and **Potashnick Construction Co.,** Cape Girardeau, Mo., will jointly build 170 miles of 16-in. from Aneth field to Cameron, Ariz. **R. H. Fulton Construction Co.,** Lubbock, Tex., will build 98 miles of 16-in. from Cameron to Seligman, Ariz., and 217 miles of 16-in. from the Colorado River to Olive, Calif. Remainder not let.
Completion: End 1957.

• **Fulton, R. H. & Co.,** Lubbock, Tex.
Project: 39 miles of 6-in. in Wyo., from Donkey Creek field to Osage pump station in Weston County.
Status: Fulton, a contractor, has applied to Wyoming Public Service Commission.

• **Great Northern Railway Co.**
Project: 400 to 600 miles of 12 to 20-in. from Williston basin in Montana and North Dakota, to Clearbrook or St. Paul, Minn.
Status: Under study.
Contractor: **Pipe Line Technologists, Inc.** has contract for feasibility study to be finished July or August 1957.

• **Interstate Oil Pipe Line Co.**
Project: 5 miles of 4-in. from South Bosco field, and 5 miles of various size from Church Point field, La., to present main line.
Status: Proposed.

• **Magnolia Petroleum Co.**
Project: 203 miles of 12, 16, and 20-in. loops between Midland and Beaumont, Tex.
Status: To start August 1957.
Contractor: **O. R. Burden Construction Corp.** has 121 miles of 16-in. and 5 miles of 12-in. between Midland and Corsicana. **H. B. Zachry Co.** has 77 miles of 12, 16, and 20-in. between Corsicana and Beaumont.
Completion: Early 1958.

• **Muskegon Pipe Line Corp.** (Aurora Gasoline Co., Service Pipe Line Co.)
Project: 165 miles of 10-in. from Griffith, Ind., to Muskegon, Mich.
Status: To start early August.
Contractor: **Service Pipe Line** is building the line.
Completion: Late 1957.

• **Northwest Pipeline Corp.**
Project 80 miles of 8-in. and 300 miles of 10-in. crude and products line from Four Corners area to Salt Lake City.
Status: Proposed.

• **Offshore Gathering Corp., Houston.**
Project: 364 miles of mostly 20-in. in Gulf of Mexico off Louisiana. (Dual line.)
Status: Proposed.

• **Oil Field Pipe Line, Inc.**
Project: 200 miles 8 and 12-in. line from near Elkhart, to Ellinwood, Kans.
Status: Proposed.

• **Pasotex Pipe Line Co.**
Project: 58 miles of 20-in. between Wink and El Paso, Tex.
Status: Under way.
Contractor: **R. H. Fulton & Co.**
Completion: September 1, 1957.

• **Salt Lake Pipe Line Co.**
Project: 100 miles of 10-in. looping of Rangely, Colo., to Salt Lake City line.
Status: Pipe has been ordered.
Completion: Late 1957.

• **Shamrock Oil & Gas Corp.**
Project: 35 miles of 6-in. to serve fields in Ochiltree and Hansford counties, Tex.
Status: Under way.

• **Shell Oil Co.**
Project: Undetermined length of 3, 4-in. in South Louisiana.
Status: Under way.
Contractor: **Brown & Root, Inc.,** W. P. Stanley, spread superintendent, office at Buras, La.
Completion: September 30, 1957.

• **Sinclair Pipeline Co.**
Project: 150 miles of 20-in. from Teague, Tex., to Houston.
Status: Planned for 1958.
Completion: 1958.

• **Skelly Oil Co.**
Project: 38 miles of 8-in. extension of its gathering system into southern Kiowa County, Kansas.
Status: Planned.
Completion: Early fall 1957.

• **Southern Kansas Pipeline, Inc.**
Project: 200 miles of 6 to 10-in. in Kans. from southwestern Meade County to 10 miles north of Arkansas City.
Status: Proposed. Request filed with Kansas Corporation Commission for permit.

• **Tecumseh Pipe Line System** (Joint venture of Sinclair Pipe Line, Ashland Oil & Refining, and Pure Oil Co.)
Project: 201 miles of 20-in. between Griffith, Ind., and Cygnet, Ohio.
Status: Under way.
Contractor: **O. R. Burden Construction Corp.** has two spreads of 93 miles from Griffith eastward and 92 miles from the mid-point to Cygnet. Remainder not let.
Completion: September 1957.

• **Texas-New Mexico Pipe Line Co.** (The Texas Co., Sinclair Pipe Line Co., Tidewater Oil Co., Empire Gas & Fuel Co.)
Project: 515 miles of 16-in. from southeast corner of Utah to Jal, N. M.

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PIPE LINE SURVEYS

Pipeline Patrol

Status: To start late 1957.
Contractor: Survey contracts went to **J. V. McCoy**, Houston, and **E. H. Schmidt and Associates**, Tulsa.
Completion: 1958.

U.S. Products Pipelines

- **Alaska-Yukon Refiners & Distributors, Ltd.**
  Project: Two lines: one 150 miles from Haines to Haines Junction, Alaska, linking with government Canol line; another from Tok Junction, on Canol line, to Anchorage.
  Status: Proposed.
  Completion: 1959.
- **American Pipe Line Co.**
  Project: Line from Gulf Coast to New York City. Has ODM approval to amortize 40 per cent of cost with fast writeoff.
  Status: Proposed.
- **Buckeye Pipe Line Co.**
  Project: Conversion of 32 miles of 8-in. crude to products between Mantua, Ohio, and Youngstown area.
  Status: Planned.
  Contractor: Company will do own work.
  Completion: November 1957.
  Project: 70 miles of 8-in. from Wayne to vicinity of Durand, Mich.
  Status: Under way.
  Completion: Early 1958.
  Project: 60 miles of 10-in. from Port Everglades, Fla., to Miami's International Airport.
  Status: Under way.
  Contractor: Buckeye will do own work.
- **Cities Service Pipe Line Co.**
  Project: 29 miles of 6-in. ethylene line from Lake Charles, La., to Orange, Tex.
  Status: Planned.
  Completion: July 31, 1957.
  Project: 168 miles of 6-in. L.P.G. line from East Chicago, Ind., to Lowell, Mich.
  Status: Under way.
  Contractor: **Somerville Construction Co.** has 98 miles from Lowell to South Bend, Ind., Robert Hively, spread superintendent, office at Ada, Mich.
  Completion: September 1, 1957.
- **Continental Pipe Line Co.**
  Project: Conversion of 99 miles of 6-in. from the Wichita Falls area to near Fort Worth, Tex., plus a 15-mile extension to the Grapevine area northeast of Fort Worth.
  Status: Conversion under way. Extension planned.
- **El Paso Natural Gas Co.**
  Project: 11 miles of 4-in. L.P.G. from Snyder Line to South Andrews Plant, Tex.
  Status: Planned
  Project: 240 miles of 6-in. from Odessa to El, Paso, Tex.
  Status: Planned.
  Contractor: **Pipeline Engineering Co.** has design and engineering contract. **Coates Field Service, Inc.** has right-of-way acquisition and claims settlement contracts.
  Completion: Early 1958.
- **Florida Pipeline & Storage Co.**
  Project: 67-mile products line from Everglades, Fla., to Homestead Air Force Base, 25 miles south of Miami.
  Status: Under way.
  Contractor: **Fish Service Corp.**
  Completion: December 1957.
- **Great Lakes Pipe Line Co.**
  Project: 93 miles of 8-in. from south of St. Paul to Eau Claire, Wis.; 68 miles of 12-in. from Great Lakes intersecting point with Badger Pipe Line to Chicago.
  Status: Under way.
  Contractor: **R. H. Fulton & Co.** has the 8-in. **Midwestern Contractors, Inc.** has the 12-in.
  Completion: Late 1957.
  Project: 15 miles of 6-in. from Lincoln, Neb., to Lincoln air base.
  Project: 140 miles of 8-in. from Minneapolis to Superior terminals.
  Project: 34 miles of 12-in. from Tulsa to Barnsdall, Okla., replacing 12, 8-in. lines.
  Contractor: **Midwestern Constructors, Inc.**
  Completion: Late 1957.
  Project: 14 miles of 8-in. from Coffeyville to Independence, Kans., replacing 4-in. line.
  Contractor: **Jess Whitlow Pipe Line Service.**
  Project: 11 miles of 8-in. from approximately 10 miles east of the Great Lakes pumping station at Donahue, Iowa, to terminals on the Mississippi River at Bettendorf, Iowa.
  Contractor: **R. T. Perry Pipe Line Construction.**
- **Laurel Pipeline Co.** (Gulf Refining Co., Sinclair Pipe Line Co., The Texas Co.)
  Project: 100 miles of 24-in. and 340 miles of line graduating down to 14-in. at the west terminus, from Philadelphia to Cleveland.
  Status: To start early 1958.
  Completion: 1958.
- **Northwest Pipeline Corp.**
  Project: 80 miles of 8-in. and 300 miles of 10-in. products and crude line from Four Corners area to Salt Lake City.
  Status: Proposed.
- **Odessa Butadiene Co.**
  Project: 240 miles of 6-in. from Odessa to El Paso, Tex.
  Status: Planned.
  Completion: March 1, 1958.
- **Ohio Oil Co.**
  Project: 350-miles of 12-in. from Wood River, Ill., to Chicago.
  Status: Work to start fall 1957.
  Completion: 1958.
- **Salt Lake Pipe Line Co.**

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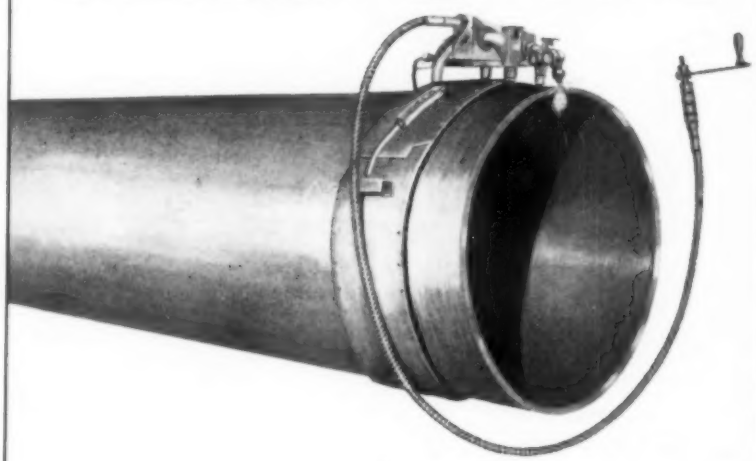

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Pipeline Patrol

Project: 80 miles of 8-in. looping of line from Boise, Idaho, to Pasco Wash.
Status: Pipe has been ordered.
Completion: Late 1957.

- **Southern Pacific Pipe Lines, Inc.**

Project: 100 miles of 10-in., 80 miles of 8-in., and 125 miles of 6-in. between Richmond, Calif., and Fallon, Nev.
Status: Under way.
Contractor: **River Construction Corp.** has 84 miles of 8, 10-in. from Richmond to Stockton, Calif., completed. **Hood Construction Co.** has 58 miles of 10-in. from Lodi to Roseville, Calif., completed. **Engineers, Limited Pipeline Co.** and **Joe E. Young Pipe Line Construction Co.** have 180 miles of 6 and 8-in. between Rocklin, Calif., and Fallon, Nev.
Completion: **August 1, 1957.**

- **Texas Eastern Transmission Corp.**

Project: 1,168 miles of 20-in. from Baytown, Tex., to Moundsville, W. Va., conversion from gas.
Status: Under way.
Completion: September 1, 1957.
Project: 231 miles of 14-in. from Seymour, Ind., to Chicago.
Status: Under way.
Completion: Fall 1957.

- **Trust Pipe Line Co.** (Cosden Petroleum)

Project: 128 miles of 6-in. from Hawley near Abilene, to Wichita Falls, Tex.
Status: Under way.
Contractor: **Pipe Line Technologists, Inc.,** has the design and engineering.
Completion: October 1957.

- **Underground Storage & Exploration, Inc.**

Project: 393 miles of 12-in. L.P.G. line from Moundsville, W. Va., to Newark, N. J., plus 95 miles of 6, 8-in. laterals to Mauch Chunk, Pa., and to Philadelphia.
Status: Proposed.

- **Union Oil Co. of California**

Project: 815-mile line from Rifle, Colo., to Los Angeles refining area, to carry products from its Rifle shale-oil plant.
Status: Proposed.

U.S. Natural-Gas Pipelines

- **American Louisiana Pipe Line Co.**

Project: 7 miles of 16-in. and 5 miles of 12-in. at North Holly Beach Field and Second Bayou Field, Cameron Parish, La.
Status: Has temporary FPC permit.

- **Arkansas Louisiana Gas Co.**

Project: A 300-mile line, plus gathering lines, from Tex.-La. coastal area to northern La., to connect with present system.
Status: **Long-range plans.**

- **Atlantic Seaboard Corp.**

Project: 14 miles of 26-in. looping in Hardy and Randolph counties, West Virginia.
Status: Has temporary FPC approval.

- **Carolina Pipeline Co.**

Project: 177 miles of 2, 3, 4, 6, 8, and 10-in. between Blacksburg and Camden, S. C.
Status: Under way.
Contractor: **Panama-Williams Corp.** has construction contract. **Coates Field Service, Inc.** has right-of-way acquisition and claims settlement contract.

- **Cascade Natural Gas Corp.**

Project: 15-mile line to General Petroleum Corp.'s refinery at Ferndale, Wash., from Pacific Northwest Pipeline Corp.'s main line.
Status: Under way.
Completion: August 1, 1957.

- **Central Hudson Gas & Electric Corp.**

Project: 46 miles of 10-in. from Albany to Kingston, N. Y.
Status: Under way.
Contractor: **Williams-Austin Construction Corp.,** O. L. Martin and Ralph Gaddy, supts. office at Catskill, N. Y.
Status: Approved. Under way.

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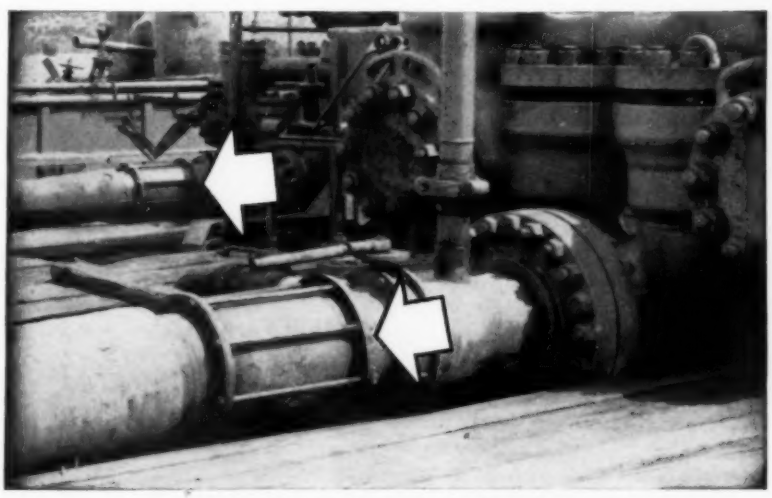

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Pipeline Patrol

Contractor: **Vaughn & Taylor Construction Co.**

Project: 4 miles of 16-in. at Sarcoxie, Mo. superintendents, office at Catskill, N. Y.

Completion: November 1, 1957.

• **Cities Service Gas Co.**

Project: 8 miles of 16-in., 20 miles of 8-in. 20 miles of 6-in., and 20 miles of 4-in. field lines in Barber County, Kansas.

Status: Approved. Under way.

Contractor: **Vaughn & Taylor Construction Co.**

Project: 3 miles of 12-in., 8 miles of 10-in., miles of 8-in., 8 miles of 6-in., and 37 miles of 4-in. field lines in Eureka Field, Okla.

Status: Approved. Under way.

Contractor: **Prairie Construction Co.**

Project: 64 miles of 6 to 30-in. in Leavenworth and Anderson counties, Kans., Cass County, Mo., and Oklahoma County, Okla.

Status: Planned.

Project: 75 miles of 30-in. from Independence to near Welda, Kan.

Status: Pending FPC approval.

• **Coastal States Gas Producing Co.**

Project: A 20-mile gathering system from the Rock Island area of Colorado County, Tex., to the United Gas Corp. system.

• **Coastal Transmission Corp.**

Project: 575 miles of 12, 20, 22, 24-in. main line and 414 miles of 2 to 14-in. gathering lines between McAllen, Tex., and Baton Rouge, La.

Status: Under way.

Completion: January 1, 1958.

• **Colonial Natural Gas Corp.**

Project: Two systems; one between Houston-Lake Charles area and Miami, Fla.; one in the Carolinas and Georgia.

Status: Proposed.

• **Colorado Interstate Gas Co.**

Project: 1957 program . . . 66 miles of 30-in., 40 miles of 34-in., 109 miles of 26-in., and 100 miles of 24-in. from Springfield, Colo., to Pueblo, Colo; 345 miles of 30-in. from Kit Carson, Colo., to Beatrice, Neb.; 30 miles of 22-in. from Laverne to Hooker, Okla.; 24 miles of 22-in. Panhandle field looping.

Status: Pending FPC approval. Has temporary approval for the 50 miles in Okla.

• **Eastern Shore Natural Gas Co.**

Project: 34 miles of 8-in. and 90 miles of 6-in. from connection with Transcontinental Gas Pipe Line Corp. in Maryland, across entire length of Delaware to Salisbury.

Status: Pending FPC approval.

• **East Ohio Gas Co.**

Project: 90 miles of 24-in., and 23 miles of 30-in. from Richfield to Summerfield, Ohio.

Contractor: **Sharman, Allen, Gay & Taylor, Inc.,** James Adams, spread superintendent, office at Wadsworth, Ohio. **Coates Field Service, Inc.** has right-of-way acquisition and claims settlement contract.

Completion: November 1957.

• **Edison Securities Co.**

Project: 130 miles of 30-in. from San Joaquin Valley fields to Wilmington, Calif.

Status: Being contested by Southern California Gas Co., Southern Counties Gas Co., and Pacific Lighting Gas Supply Co.

Contractor: **Bechtel Corp.**

• **El Paso Natural Gas Co.**

Project: 74 miles of 34-in. San Juan main line loops.

Status: Planned. Filed for FPC permit.

Completion: August 1957.

Project: 94 miles of 18-in. from Panoma Plant, Gray County, to Dumas Plant, Moore County, Texas.

Status: Under way.

Contractor: **R. H. Fulton & Co. Coates**

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Pipeline Patrol

Field Service, Inc. has right-of-way acquisition and claims settlement contract.

Completion: July 1957.

Project: 177 miles of 20-in. from Sonora Plant, Sutton County, to Plains Plant, Yoakum County, Texas.

Status: Planned. Filed for FPC permit.

Completion: January 1958.

Project: 74 miles of 30-in. Permian-San Juan main line loops.

Status: Planned. Filed for FPC permit.

Completion: January 1958.

Project: 216 miles of 6 to 34-in. and 533 miles of various size in Ariz., Tex., N. M.

Status: Filed for FPC permit.

Project: 47 miles of 30-in. from proposed Lindrith, N. M., plant to proposed Chaco, N. M., plant.

Status: Under way.

Contractor: **Foutz & Bursum Construction Co.**

Completion: 1957.

Project: 38 miles of various size line to make additional gas available for processing at the McElroy-Wilshire gasoline plant (recently purchased from Lone Star Producing Co.) near Crane, Tex.

• **Houston Texas Gas & Oil Corp.**

Project: 702 miles of 24-in. from Baton Rouge, La., to Kissimmee, Fla.; 240 miles of 18-in. from Kissimmee to Cutler, Fla.; 642 miles of 3 to 18-in. sales laterals in Florida. Main line to join Coastal Transmission's proposed line from McAllen, Tex., to Baton Rouge.

Status: Under way.

Contractor: **Midwestern Constructors** has the 702 miles of 24-in.; **Harbert Construction Corp.** has remainder.

Completion: June 1958.

• **Illinois Power Co.**

Project: 6 miles of 6-in. line between Hoffman and Carlyle, Ill., plus distribution lines.

Status: Under way.

Contractor: **Mid-States Construction Co.,** H. A. Hane, spread superintendent, office at Carlyle, Ill.

Completion: September 1, 1957.

• **Intermountain Gas Co.**

Project: 16 miles of 6-in. from Payette to Weister, Ida.

Contractor: **Hood Construction Co.,** V. H. Bailey, supt., office at Payette.

Completion: September 15, 1957.

Project: 16 miles of 6-in. near Mountain Home, Ida.

Contractor: **Hood Construction Co.,** Sam Shearman, supt., office at Boise.

Completion: September 1, 1957.

• **Iron Ranges Natural Gas Co., St. Paul**

Project: 68-mile transmission line and 47 miles of laterals to supply towns on the Mesabi Iron Range, Minn.

Status: Application pending with FPC.

• **Kansas-Nebraska Natural Gas Co.**

Project: 61 miles of various size gathering line in Camerick field, Texas County, Okla.

Status: Approved.

• **Manufacturers Light & Heat Co.**

Project: 50 miles of 10, 12-in. from Waynesburg to Pittsburgh, Pa.; 40 miles of 16-in. and 20 miles of 6 to 12-in. from Corning to Dundee, N. Y.

Status: Under way.

Contractor: **Harford Brothers,** A. M. Harford and Robert Mann, superintendents.

Completion: September 15, 1957.

• **Michigan Consolidated Gas Co.**

Project: 67 miles of 10 and 12-in. between Sears and Travers City, Mich.

Status: Under way.

Contractor: **Somerville Construction Co.;** Floyd Huduall, spread superintendent, office at Cadillac, Mich.

Pipeline Patrol

Project: 60 miles of 10 and 12-in. between Muskegon and Ludington, Mich.
Status: Under way.

Contractor: **Somerville Construction Co.,** jointly with **J. L. Gentry Construction;** Frank Morris, superintendent, office at Hart, Mich.

- **Michigan Gas Storage Co.**
Project: 6 and/or 8-in. gathering lines and various 4-in. well lines in central Mich.

- **Michigan Wisconsin Pipe Line Co.**
Project: 24 miles of 24-in. and 18 miles of various size looping in Michigan, Indiana, Illinois, Wisconsin, Iowa, and Missouri.
Status: Approved.
Completion: October 1, 1957.

- **Midwestern Gas Transmission Co.**
Project: Will build main line from Portland, Tenn., to Canadian border near Emerson, Man.; 829 miles of 24-in., 109 miles of 16-in., 174 miles of 12-in., plus 648 miles of 3 to 18-in. extensions in Minn. and Wis.
Status: Application pending with FPC.

- **Mississippi River Fuel Corp.**
Project: 54 miles of 26-in. loops in La., Mo., Ark.
Status: Pending with FPC.

- **Montana-Dakota Utilities Co.**
Project: 28 miles of 12-in. from Fallon County to Dawson County, Montana.
Status: Approved.
Project: 6 miles of 12-in. between Mandan and Bismarck, N. D.
Status: Has temporary approval.

- **Mountain Fuel Supply Co., Salt Lake City**
Project: 38 miles of 20-in. to connect with Pacific Northwest Pipeline Corp.'s system in Sweetwater County, Wyoming.
Status: Approved.
Project: Extension of 12-in. line from Ogden to Logan and Brigham City, Utah.
Status: Has applied to Utah Public Service Commission.
Completion: Late 1957.

- **Natural Gas Pipeline Co. of America**
Project: 350 miles of 20 and 26-in. from Jack and Wise counties, Texas, to Fritch Tex., plus a gathering system.
Status: Under way.

Contractor: **R. H. Fulton & Co.** has Red River crossing in northern Montague County. **Fulton & Brodie, Inc.,** Lubbock, Tex., has gathering system. **Eastern Pipeline Contractors,** Dallas, has 80 miles of 20-in. from Bridgeport, Tex., to Healdton, Okla. **River Construction Corp.** has 173 miles from Mountain View, Okla., to Fritch, Tex. **H. B. Zachry Co.** has 87 miles of 26-in. between Healdton and Mountain View, Okla.
Completion: January 1, 1958.
Project: 389 miles of 36-in. loops along its line from Beatrice, Neb., to Chicago, to take gas from proposed line of Colorado Interstate Gas Co., and 91 miles of 30-in. loops along parts of its main line.
Status: Application pending with FPC.
Project: 337 miles of 30-in. between Fritch, Tex., and Beatrice, Neb., and 59 miles of 36-in. between Beatrice and Joilet, Ill., along existing system.
Status: Pending FPC approval.
Completion: 1959.

- **New York State Natural Gas Corp.**
Project: 15 miles of 30-in. from Horseheads to Newfield, N. Y.; 31 miles of 20-in. from Harrison to Woodhull, N. Y.; 10 miles of 12-in. from Stockbridge to Oneida, N. Y
Status: Planned.
Project: 12 miles of 12-in. near Oneida, N. Y.
Status: To start September 15, 1957.
Contractor: **Harford Brothers,** A. M. Harford and Robert Mann, superintendents.
Completion: October 15, 1957.

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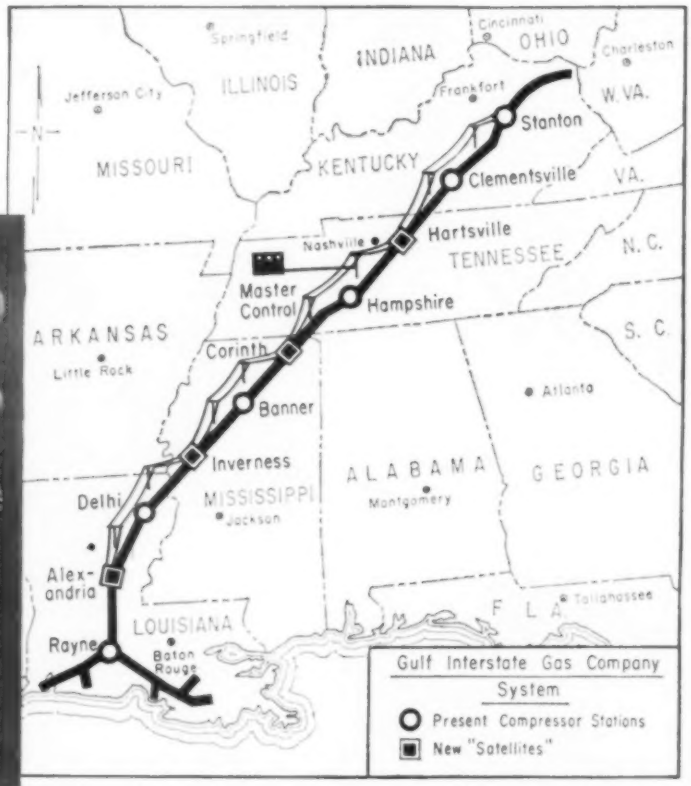
Gulf Interstate's unattended "satellite" station shows how UNION C.T.C. lowers costs with safety and reliability.

UNION Control Panel at Stanton, Ky.



Construction is under way on four new engine-driven centrifugal compressor stations. All will be remotely controlled unattended "satellites." Operations will be directed from a UNION master control panel near the center of the system.

The Gulf Interstate Gas Company's "satellite" station at Stanton, Kentucky provides most economical and safe operation, according to Mr. R. Lo Chiano, assistant chief engineer at Gulf Interstate.

The Stanton station is remotely controlled from Clementsville, Ky., 90 miles away, through a UNION Centralized Transport Control System and has been on completely *unattended* operation since June 1956. This system is unique because it provides remote control and indications for a turbocharged engine driving a centrifugal gas compressor . . . the first installation of its kind. Large savings result because the operator at the master station can change the set point on the discharge pressure controller and start and stop the engine at Stanton.

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The unattended station is definitely successful. There have been no false shut-downs that were not man made. With this in mind, future stations are being patterned after the one at Stanton.

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Pipeline Patrol

• **Niagara Mohawk Power Corp.**
Project: 14 miles of 18-in. from Phoenix to Palermo, N. Y.
Status: Planned.
Completion: October 1, 1957.
Project: 261 miles of 2 to 16-in. transmission and distribution mains to service areas in central, eastern and northern New York.
Status: Planned.
Contractor: Various.
Completion: December 31, 1957.

• **North Carolina Natural Gas Corp.**
Project: 630 miles of 2 to 16-in. from Transcontinental Gas Pipe Line Corp.'s system near Mooresville, eastwardly across N. C.
Status: To start fall 1957.
Completion: Spring 1958.

• **Northern Natural Gas Co.**
Project: 160 miles of 2, 3, 6, 8-in. branch lines to serve 20 new communities on Aberdeen, S. D., line.
Status: Under way.
Contractor: **Troth Construction Co.**
Project: 73 miles of 20-in. from Savana Creek to Pincher Creek fields in Alberta, Canada; 32 miles of 24-in. from Pincher Creek to Montana border; 1,100 miles of 26-in. from Montana into Minneapolis.
Status: Planned.
Project: 365 miles of main line and 1,090 miles of branch lines to serve communities in Minn., Iowa, S. D., Nebr., Wis.
Status: Filed with FPC March 18, 1957.
Project: 13 miles of 16-in. to replace existing 10-in. line in Hansford County, Texas.
Status: Has temporary FPC authority.

• **Offshore Gathering Corp.,** Houston.
Project: 364 miles in Gulf of Mexico off Louisiana: 60 miles of 24-in., 70 miles of 26-in., 234 miles of 30-in. (Dual line.)
Status: Application pending with FPC.

• **Ohio Fuel Gas Co.**
Project: 11 miles of 18-in. and 11 miles of 20-in. from Gibsonburg, Ohio to Toledo; and 30 miles of 24-in. looping from Pavonia to Attica, Ohio.
Status: Pending FPC approval.
Project: 152 miles of line in Ohio: 43 miles of 24-in. from Crawford Station to Utica; 18 miles of 24-in. from Pavonia Station to Line D; 6 miles of 20-in. from Mount Gilead to Claridon; 4 miles of 20-in. near Dayton; 4 miles of 20-in. near South Charleston; 7 miles of 16-in. near Springfield; 6 miles of 20-in. nnear Oberlin; 17 miles of 20-in. from Oak Hill to Symmes Station; 7 miles of 12-in. from Mount Sterling to Bloomingburg; 2 miles of 8-in. near Bellefontaine; 3 miles of 12-in. near Mansfield; 4 miles of 12-in. near Lakeville; 7 miles of 8-in. in Guernsey and Belmont counties.
Status: Under way.
Contractor: **O. R. Burden Construction Corp.** has the 43 miles of 24-in. from Sugar Grove near Crawford station, to Utica, Ohio, and 27 miles of 20-in. south from Wellston.
Completion: Second half 1957.

• **Pacific Gas & Electric Co.**
Project: 138 miles of 34-in. looping of the Topock-Milpitas line.
Status: Under way.
Contractor: **Engineers Limited Pipeline Co.**
Completion: December 1, 1957.
Project: 5 miles of 16-in., 160 miles of 12-in., 8 miles of 6-in. from Corning to Eureka, Calif.
Status: Planned.
Contractor: **Engineers Limited Pipeline Co.** and **Alex Robertson Co.**
Completion: January 1, 1958.
Project: 13 miles of 12-in., 2 miles of 10-in., from Santa Cruz to Davenport, Calif.
Status: Planned.
Completion: October 1957.

• **Pacific Northwest Pipeline Corp.**
Project: 37 miles of 6-in. from Dove Creek to Nucla, Colo., and 13 miles of 4-in. from Nucla to Urvan, Colo.
Status: Has FPC permit.
Project: 1,000 miles of gathering lines and laterals along present line.
Status: Planned.
Completion: 1957.
Project: 35 miles of 4, 6-in. laterals from its 26-in. Shonohomish County, Wash., line to Grotto, Wash.; 5 miles of 3-in. lateral from its Urvan, Colo., lateral to Slick Rock, Colo.; 41 miles of 6-in. from its Coeur d'Alene lateral to near Kellogg, Idaho; 37 miles of 8-in. from Spokane to Moses Lake, Wash.
Status: Has temporary FPC approval.

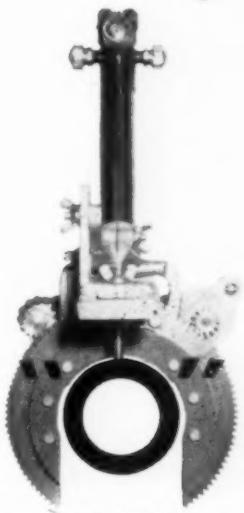
• **Pennsylvania Gas Co.**
Project: 23 miles of 10-in. in Erie County, Pa., 15 miles of 8-in. in Warren and Chautauqua counties, Pa., 30 miles of branch lines, several small distribution lines.
Status: Has FPC permit.

• **Peoples Natural Gas Co.**
Project: 58 miles of 2 to 14-in. extension and replacement lines in Pennsylvania.
Status: Under way.
Completion: September 1957.

• **Permian Basin Pipeline Co.**
Project: 83 miles of 16-in. from its Spraberry station in Midland County, Tex., to tie in with Pioneer Gathering System, Inc. in northwestern Schleicher County, Tex.
Status: Has temporary FPC approval.

• **Phillips Petroleum Co.**
Project: 3 miles of 24-in. in Moore County, Texas.
Status: Planned.
Completion: October 1, 1957.
Project: 30 miles of 3 to 8-in. in Moore,

model "O" for small diameter pipe cutting and beveling



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Pipeline Patrol

Hutchinson, Sherman, Hansford, and Gra counties, Tex., and in Texas County, Okla.
Status: Planned.
Contractor: Various.
Completion: January 1, 1958.

- **Piedmont Gas Co.**
Project: 78 miles of 2 to 8-in. extension off Trancontinental in North Carolina to serve Gaston, Lincoln, Catawba, Caldwell and Burke counties.
Status: Has FPC approval.

- **Pioneer Gathering System, Inc.**
Project: 70 miles of mostly 16, 12-in. in Val Verde, Schleicher, Sutton counties, Tex.
Status: Under way.
Competion: Early fall 1957.

- **Signal Oil & Gas Co.**
Project: 80 miles of gathering lines to Tioga, N. D., gasoline plant from South Blue Buttes, Antelope, and North Blue Buttes, McKenzie County, N. D.
Status: Under way.
Contractor: **C. P. Bartley & Son.**
Completion: October 1, 1957.

- **Southern California Edison Co.**
Project: 200-mile line from San Joaquin Valley gas fields Redondo Beach, Calif.
Status: Under way.
Completion: 1957.

- **Southern California Gas Co. and Southern Counties Gas Co. of California.**
Project: 4 miles of 30-in. from Los Angeles River to Victoria Station at Los Angeles.
Status: Planned.
Completion: July 30, 1957.

- **Southern Natural Gas Co.**
Project: 10 miles of 8-in. laterals in Napoleonville Field and Fort Jackson Field, La.
Status: Has FPC approval.
Completion: December 1, 1957.
Project: 32 miles of 6-in. from Chandeleur Sound area, Breton Island, La.; 7 miles of 8-in. and 5 miles of 10-in. from Main Pass area to Olga, La.; 9 miles of 8-in. from Bastian Bay Field to Fort Jackson Field; 7 miles of 8-in. laterals in Manila Village Field.
Status: Plan to apply for FPC permit.
Completion: December 1, 1957.

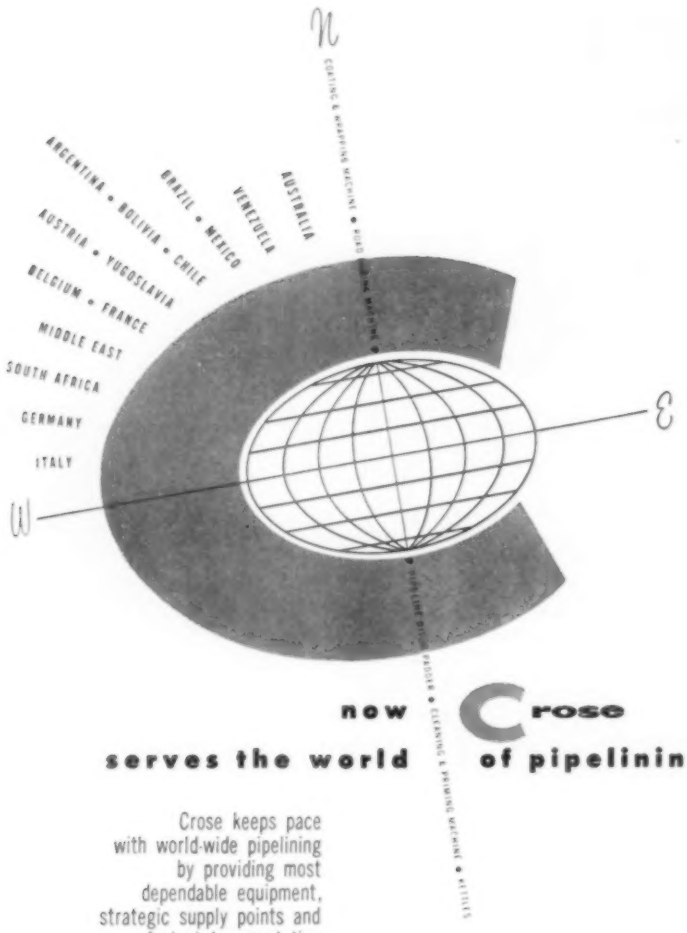
- **Spokane Natural Gas Co.**
Project: 400 miles of 1 through 24-in. distribution system at Spokane.
Status: Under way.
Contractor: **Hallmac Construction Co.**; V. L. Williams, supt., office at Spokane.
Completion: 1957.

- **Tennessee Gas Transmission Co.**
Project: 221 miles of 30-in., 101 miles of 26-in., and 10 miles of 24-in. looping from Portland, Tenn., to Greenup, Ky.; from Morehead, Ky., to Catlettsburg, Ky.; from Catlettsburg to Broad Run, W. Va.; from New Wilmington, Pa., to Mercer, Pa.; and from New Castle, Pa., to near Pittsburgh, Pa.
Status: Pending FPC approval.
Contractor: **Bechtel Corp.** has 24 miles of 30-in. from Olive Hill to Greenup, Ky., to complete August 3, 1957, M. A. (Slim) Roberts, supt., office at Grayson, Ky. **Oklahoma Pipe Line Constructors** has 35 miles of 30-in. in Ky., Gene Gohring, supt., office at Richmond.
Project: 51 miles of 26-in., 51 miles of 20-in., and 17 miles of 12-in. gathering lines from Kinder, La., to offshore fields in Gulf of Mexico.
Status: Has temporary FPC approval.
Project: 577 miles of 30-in. from Mississippi River delta area south of New Orleans to Portland, Tenn.
Status: Pending FPC approval.
Project: 76 miles of 24-in. between Coudersport, Pa., and Hamburg, N. Y.
Status: Pending FPC approval.
Project: 33 miles of 6, 8, 10-in. laterals in Southwest Pass area below New Orleans.
Contractor: **Houston Contracting Co.**, H. E. Murphy, supt., office at Venice.

- **Texas Eastern Transmission Corp.**
Project: 17 miles of 8-in. and 3 miles of 6-in. from its 20-in. Baytown-Hankamer line to Alco-Mag field in Harris County, Texas.
Status: Has FPC approval.
Project: 97 miles of 30-in. loops between Kosciusko, Miss., and Uniontown, Pa., and 40 miles of 10-in. laterals.
Status: Has FPC approval.
Completion: September 1, 1957.
Project: 667 miles of 30-in. from Kosciusko, Miss., to Uniontown, Pa.
Status: Under way.
Contractor: **H. C. Price Co.** (64 miles from Barton, Ala., to Mount Pleasant, Tenn.; 51 miles from Mount Pleasant to Gladeville, Tenn.; 52 miles from Gladeville to Tompkinsville, Ky.; 68 miles from Tompkinsville to Danville, Ky.; 63 miles from Danville to Owingsville; 46 miles from Owingsville to Wheelersburg, Ohio. Will use four spreads); **Williams Brothers Co.** (63 miles from Egypt, Miss., to Barton, Ala.; 64 miles from Berne, Ohio, to Uniontown, Pa.); **Houston Contracting Co.** (80 miles from Kosciusko to Egypt, Miss.; 57 miles from Wheelersburg to Athens, Ohio, W. H. Hayes, supt., office at Oak Hill; 61 miles from Athens to Berne, Ohio, R. E. Thornton, supt., office at Caldwell).
Completion: Fall 1957.

- **Texas Illinois Natural Gas Pipeline Co.**
Project: 10 miles of 36-in. to loop existing single 30-in. near Joliet, Ill.
Status: Has FPC approval.

- **Transcontinental Gas Pipe Line Corp.**
Project: 172 miles of 36-in., 68 miles of



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Pipeline Patrol

30-in., 162 miles of 24-in., and 64 miles of smaller size loops from Tex. to N. J.

Status: Work in North Carolina under way.

Contractor: **Western Construction Co.** has 65 miles of 36-in. and 45 miles of 30-in. at scattered spots along system in S. C., N. C., Pa., and Va. Work will start in N. C., office at Winston-Salem.

Completion: December 1957.

Project: 110 miles of 36-in., 16 miles of 30-in., and 13 miles of 24-in. looping in S. Car., Ga., Ala., Miss., and La.

Status: Under way.

Contractor: **Sharman, Allen, Gay & Taylor, Inc.,** E. D. Singleton, superintendent.

Completion: November 1957.

Project: 57 miles of main line in La., Miss., Ala., Ga., S. C., and 247 miles of laterals in Tex. and La.

Status: Has temporary FPC approval.

- **Trans-Western Pipe Line Co.** (Warren Petroleum, Monterey Oil Co., J. B. Butler.)

Project: A line from Four Corners area to Calif. border.

Status: Proposed.

- **United Gas Pipe Line Co.**

Project: 40 miles of 8-in. from Baldwin County, Alabama, to Container Corp.'s plant.

Status: Has FPC permit.

Canadian Crude-Oil Pipelines

- **Act Oils, Ltd.**

Project: A 450-mile line from the Peace River region of northern B. C. to tidewater at Bella Coola, B. C.

Status: Request has been made for permit from the B. C. government.

- **B-A Alberta Pipe Line, Ltd.**

Project: 35 miles of 8-in. to connect Drumheller field, Alberta, with existing lines running to Edmonton.

Status: Pending approval.

- **Interprovincial Pipe Line Co.**

Project: 156 miles of 20-in. to extend present line from Sarnia to Port Credit, Ont.

Status: Under way.

Contractor: **Robert Somerville Co., Ltd.** and **Sheehan Constructors of Canada, Ltd.** have 90 miles from Sarnia to Bright, Ont., Jim Brown, supt., office at Strathroy.

Completion: September 1, 1957.

Project: 79 miles of 26-in. from Clearbrook Minn., to Superior, Wis.

Status: Under way.

Contractor: **R. H. Fulton & Co.**

Completion: August 31, 1957.

- **Pembina Pipe Line, Ltd.**

Project: 100 miles of 3 to 12-in. gathering line in Pembina oil field, Alta.

Contractor: **Universal Pipe Line, Ltd.,** subsidiary of Mannix, Ltd., T. Childress, spread superintendent, office at Drayton Valley, Alta.

Completion: November 1, 1957.

- **Royalite Oil Co., Ltd.**

Project: 250-mile line from Athabasca oil sands, northeastern Alta., to Edmonton.

Status: Long range plans.

Completion: 1960.

- **Trans Mountain Oil Pipe Line Co.**

Project: 100 miles of 30-in. loops: 50 miles east of Kamloops, B. C., and 50 miles west of Edson, Alta.

Status: Under way.

Contractor: **R. A. Conyes Construction Co.** has the 50 miles east of Kamloops; **Dutton-Williams Brothers, Ltd.** has other 50.

Completion: July 31, 1957.

- **Westspur Pipe Line Co.**

Project: 20 miles of 12-in. from Alida in southeastern Saskatchewan, to the Carnduff Glen Ewen area to tap Cantal, Hastings Florence, Carnduff, and Glen-Ewen fields 34 miles of 4, 6, 8-in. gathering lines.

Completion: River crossing completed. Total project to be completed in 1960.

Status: Has requested permit from Board of Transport Commissioners.

Contractor: **Majestic Contractors, Ltd.** Jeff Minter, supt., office at Estevan, Sask.

Completion: No date set.

Project: 75 miles of 16-in. from Steelman, Sask., to Cramer, Man., Canada

Status: Under way.

Contractor: **Gragg (Canada), Ltd.**

Completion: July 30, 1957.

Canadian Products Pipelines

- **Hydrocarbons Pipeline Co.**

Project: 800 miles of 6 and 8-in. L.P.G. line from near Edmonton, Alta., to Fort William, Ont.

Status: Has permit from Parliament of Canada. If approved by Federal Board of Transport Commissioners and the Alberta Petroleum and Natural Gas Conservation Board, work will start in 1957.

Construction consultants: **Dutton-Williams Brothers, Ltd.,** and **A. D. Little Co.**

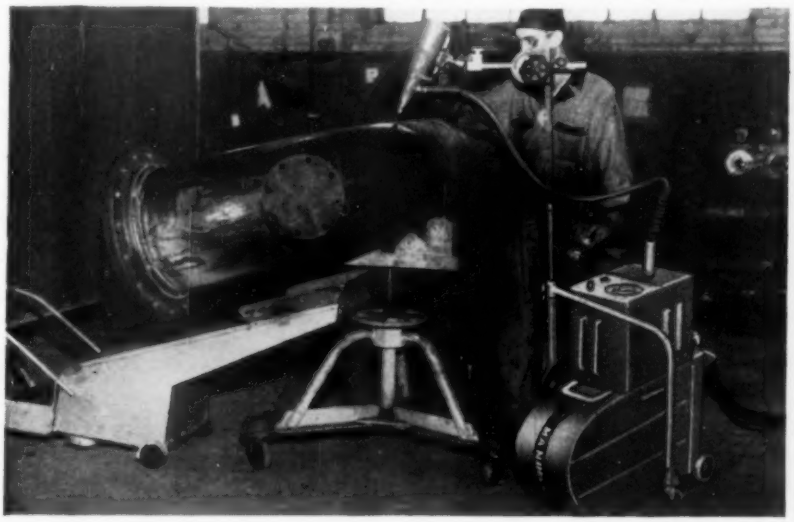
Canadian Natural-Gas Pipelines

- **Alberta Gas Trunk Line Co., Ltd.**

Project: 637 miles of 34 to 16-in. gathering lines in Alberta.

Status: Under way.

Contractor: **Dutton-Williams Brothers, Ltd.** has preliminary studies, design and management-engineering. **Universal Pipe Line, Ltd.** subsidiary of Mannix, Ltd., jointly with **Marine Pipeline & Dredging Co.,** has crossing of Red Deer River near Cavendish, Alta., J. Hysuick, spread superintendent, office at Empress. **Fulton Banister, Ltd.,** has 17 miles of 34-in. west from Burstall, Sask., to near Cavendish, Alta., and 100 miles of 18-in. north to Bindloss and Provost fields, George Caron, supt., office at Empress, Alta., to complete summer 1957.



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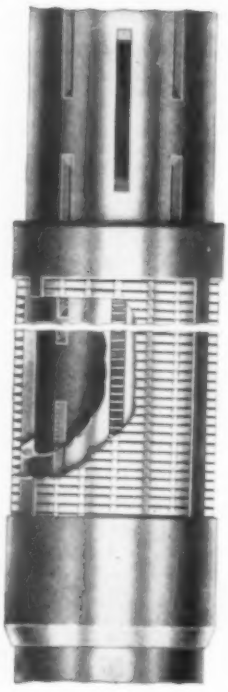

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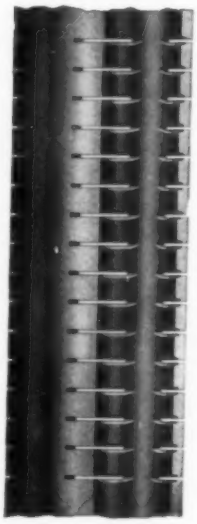

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Pipeline Patrol

• **Inland Natural Gas Co., Ltd.**
Project: 304 miles of mainline and 7 miles of laterals from Savona to Nelson B. C.: 150 miles of 12-in.; 112 miles of 10-in 67 miles of 6-in. Also will build 400 miles of distribution piping in 31 towns
Status: Under way.
Contractor: **Dutton-Williams Brothers, Ltd.** Pat Campbell, manager, office at Perticton.
Completion: October 1, 1957.

• **North Canadian Oils, Ltd.**
Project: 47-mile extension into Jasper, Alta., of its 10-in. line from Wabamun to Hinton west of Edmonton.

• **Northern Ontario Pipe Line Crown Corp.**
Project: 675 miles of 30-in. from the Ontario-Manitoba border to near Kapuskasing, Ont. (part of the 2,250-mile Trans-Canada line; will be leased to Trans-Canada Pipe Line Co. with option to buy.)
Status: 79-mile section from Stedman to Forham Township under way.

Contractor: **Dutton Williams Brothers** has 58 miles from the Manitoba-Ontario border west of Kenora to a point east of the crossing of Ontario Highway 17. **Morrison Shivers, Ltd.** has 94 miles from the east crossing of Highway 17 to a line separating the townships of Hyndman and Hodgson. **Majestic Contractors & Associates** has 80 miles from the Morrison Shivers terminal to Stedman Township. **Houston Contracting Co.** has 79 miles from Stedman to Forham Township, R. L. **Silar**, spread superintendent, office at Raith, Ont.

Contractor: **River Construction Corp.**, has Winnipeg River crossing near Kenora, Ont. to complete November 15, 1957.
Completion: End 1957.

• **Plains-Western Gas & Electric.**
Project: 25 miles of 10-in. from the Trans-Canada Pipe Line to Brandon, Manitoba.
Status: Under way.
Contractor: **Banister Construction, Ltd.** Ole Johnson, superintendent.
Completion: September 1, 1957.

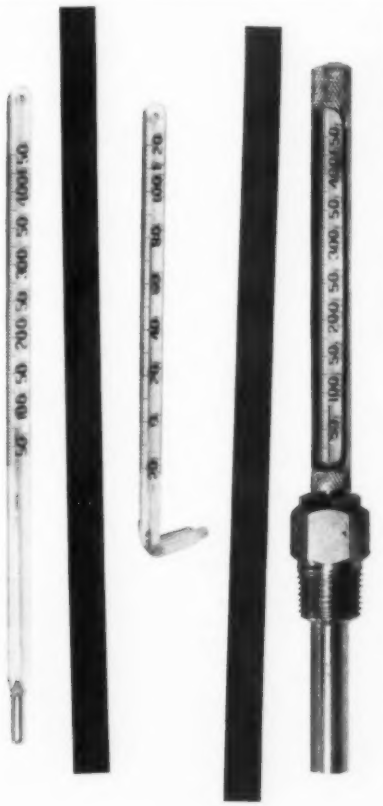
• **Provo Gas Producers. Ltd.**
Project: 22 miles of 3 to 12-in. gathering lines and wellhead tie-ins in Provost Field, Alta.
Status: Under way.
Contractor: **Fulton Banister, Ltd.**, Jim Boyce, supt., office at Consort.

• **Saskatchewan Power Corp.**
Project: 300 miles of 1 to 20-in. distribution lines at Regina, Sask.
Status: Planned.
Contractor: **S. E. Construction (Alberta) Ltd.**, and **Pacific Pipeline Construction (Alberta), Ltd.**, jointly.

• **Trans-Canada Pipe Lines, Ltd.**
Project: 574 miles of 34-in. from the Alberta-Saskatchewan border to Winnipeg, 310 miles of 20-in. from Toronto to Montreal, 33 miles of 24-in. from Toronto to Niagara, N. Y. (First part of 2,250-mile line from Alberta to Toronto and Montreal. One 675-mile section is being built by Northern Ontario Pipeline Crown Corp.)
Status: Under way.
Contractor: **Majestic Contractors, Ltd.** (104 miles from Burstall to Stewart Valley, Sask., R. L. Leonard, supt., office at Cabri); **Canadian Bechtel, Ltd.** (110 miles from Swift Current to Moose Jaw, Sask., completed, and 87 miles from Portage la Prairie to Winnipeg, Man., to complete August 20, 1957, J. L. (Joe) Work, supt., offices at Portage la Prairie and Winnipeg); **Universal Pipe Line, Ltd.**, subsidiary of Mannix, Ltd. (90 miles from Moose Jaw to Welseley, Sask., supt., Otis Hare, office at Regina, Sask.); **Dutton-Williams Brothers, Ltd.** (97 miles from Deveren to Moosomin, Sask., to complete August 1957, plus 120 miles of 20-in. between Toronto and Montreal); **Price-Poole of Canada, Ltd.** (100 miles from near McGregor to Miniota, Man.); **Oklahoma Pipe Line Constructors** (83 miles of 20, 24-in. between Toronto and Montreal, and between Toronto and Niagara, N. Y.); **Grayco Constructors, Inc.** (120 miles of 20-in. between Toronto and Montreal).
Completion: September 1957.
Project: 82 miles of 30-in. from near Winnipeg to the Ontario-Manitoba border.
Status: Under way.
Contractor: **Majestic Contractors, Ltd.**, K. B. Killingsworth, spread superintendent, office at Ste. Anne, Man.
Completion: October 15, 1957.

• **Union Gas Co. of Canada, Ltd.**
Project: 142 miles of 26-in. from Dawn Township to Hamilton, Ontario, plus 55 miles of 6 to 20-in. laterals, and 317 miles of 2 to 12-in. distribution lines.
Status: Planned.
Contractor: **Bechtel Corp.** has the 26-in. line, to complete November 10, 1957, office at Galt, Ont.
Completion: November 30, 1957.
Project: 17 miles of 8 to 20-in. storage lines in Dawn Township, Ontario.
Status: Planned.
Completion: August 1957.

• **Westcoast Transmission Co., Ltd.**
Project: 650 miles of 30-in. from Peace River area, Alta., to Sumas, Wash., plus gathering lines.
Status: Under way.
Contractor: **Dutton-Williams Brothers, Ltd.** (120 miles from Taylor B. C. to Azouzetta Lake, completed); **Universal Pipe Lines, Ltd.**, subsidiary of Mannix, Ltd. (110 miles between Huntingdon and Kingsvalle, B. C.,



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Pipeline Patrol

F. L. Byers, supt., office at Hope, B. C.); **Canadian Bechtel, Ltd.** (210 miles from Alexandria to Pine Pass, B. C., H. F. (Hank) Mogg, general supt., office at Prince George, B. C.); **R. A. Conyes Construction Co.** (210 miles); **River Construction Corp., Ltd.** (142 miles of 12, 18, 20, 26-in. gathering lines in northern Alta and B. C., E. L. (Tex) Maggard, supt., office at Dawson Creek, B. C.); **Marine Pipeline & Dredging, Ltd.** (Fraser and Peace River crossings.)

Completion: Dutton-Williams and Marine Pipeline work completed. R. A. Conyes to finish work September 1957. Universal Pipe Lines and River Construction Corp. to complete work September 1, 1957. Bechtel to finish August 20, 1957.

Project: 174 miles of 30-in. from Savanna Creek area, Alta., to Canadian-Idaho border.

Status: Proposed.

Foreign Crude-Oil Pipelines

- **Bolivian Gulf Oil Corp.**
  Project: 160 miles of 10-in. and 43 miles of 8-in. from Sicascia to Arica on the Chilean coast.
  Status: To start late 1957.
  Contractor: Williams Brothers Co.
  Completion: 1958.
- **Burmah Oil Co., Ltd.**
  Project: 850 miles of 20-in. from Nahorkativa to Calcutta, India.
  Status: Proposed.
- **Caltex**
  Project: 30 miles of 30-in. from Duri field in Sumatra to Dumai where a deepwater terminal will be built. Line will be extended 35 miles to Minas field later.
  Status: Planned.
  Completion: Duri-Dumai line to be finished in 1959; extension to Minas later.
- **Colombian Petroleum Co.**
  Project: 42 miles of 6-in. from Tibu field to Rio de Oro in Colombia.
  Status: Under way.
- **C.R.E.P.S., Societe Nationale de Recherche et d'Exploitation des Petroles en Algerie (SN Repal), and Cie. Francaise des Petroles Algerie**
  Project: Two 10-in. lines from Hassi Messaoud and Edjele, Algeria to the railhead at Touggourt.
  Status: Planned.
  Completion: 1958.
  Project: 450 miles of 16-in. from Edjele field in southeastern Algeria to a Mediterranean port on the Libyan coast.
  Status: Pipe has been ordered.
- **Creole Petroleum Corp.**
  Project: 87 miles of 30-in. from Temblador field to Caripito in Venezuela.
  Status: To start work early 1958.
  Contractor: **Pipe Line Engineering Co.** and **Oklahoma Pipe Line Constructors.**
  Completion: April 1958.
  Project: 9 miles of 26-in. from Ule to La Salina in Venezuela.
  Status: Planned.
  Completion: Late 1957.
- **Deutsche-Shell A.G.**
  Project: 120 miles of 20, 24-in. from Marseilles, France, to Rotterdam, Germany, to tap the 700 mile trans-Europe line proposed by the Royal Dutch-Shell Group.
  Status: Planned.
  Completion: 1960.
- **Iraq Petroleum Co.**
  Project: About 600 miles of up to 40-in. from Kirkuk field through Iraq to Turkish port of Iskenderun on the Mediterranean.
  Status: Proposed. Survey completed.
- **Mene Grande Oil Co.**
  Project: 97 miles of 30-in. from fields in Eastern Venezuela to Puerto La Cruz.
  Status: Under way.
  Contractor: **Fulghum Contracting Corp.** has 22 miles between Oficina and Anaco.
  Completion: First quarter 1958.
- **Middle East Pipeline**
  Project: 1,500 miles of 38 and 40-in. line from Persian Gulf to Mediterranean at Iskenderun, Turkey.
  Status: Proposed.
- **National Iranian Oil Co.**
  Project: A 1,000-mile line to move Qum crude to the Mediterranean.
  Status: Under study.
- **North-West Oil Pipelines Co. (newly formed by six West German refiners, headed by affiliates of Standard Oil Co. (N.J.), and British Petroleum Co., Ltd.)**
  Project: 210-mile line from the refining centers in the industrial Ruhr area of West Germany to Wilhelmshaven.
  Status: Planned.
  Completion: 1959.
- **Royal Dutch-Shell**
  Project: 700-mile line across Europe from the Mediterranean to the North Sea, running through Eastern France, Luxembourg, West Germany, and Netherlands, and Belgium. Main trunk to be 30-in.
  Status: Company is considering project together with several other companies.
- **Standard-Vacuum Petroleum Maatschappij.**
  Project: 94 miles of 8-in. from Lirik field, Central Sumatra, to deep-water terminal on Siak River, near Buatan. A 3-in. hot-water "defroster" line will be laid under the 8-in. to heat the heavy crude.
  Status: Under way.
  Completion: Late 1957.

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Pipeline Patrol

• **Ste. Nationale de Recherche et d'Exploitation des Petroles en Algerie**

Project: Line in Sahara Desert area to move oil from Hassi Massaoud field. Two routes possible: 200 miles from the field northwest to Laghouat; 260 miles from the field to the north and slightly east to Biskra.

Status: Under study.

• **Union of Soviet Socialist Republic**

Project: 2,300-mile Trans-Siberian crude-products line from Ufa Tuimaza fields in Bashkiria to Irkutsk near Lake Balkal.

• **Yacimientos Petroliferos Fiscales** (Argentina)

Project: 932 miles of 12-in. from Campo Duran to San Lorenzo.

Status: Under way.

Contractor: **TECHINT** (Compania Tecnica Internacional), Buenos Aires, has 90 miles.

Foreign Products Pipelines

• **Empresa Nacional de Petroleos** (Government of Chile) and **Cia. de Petroleos de Chile (Copec), et al.**

Project: 75 miles of 10-in. from Chile's coastal refinery at Concon to Santiago.

Status: To start work September 1957.

Contractor: **Williams Brothers**

Completion: Early 1958.

• **Israeli Government**

Project: A 6-in. line from the Haifa refinery to Tel Aviv.

Completion: Late 1957.

• **North Atlantic Treaty Organization**

Project: 2,000 miles of lines to airfields in parts of Europe.

Status: Under way.

Contractor: **Associated Pipeline Contractors, Inc.** (450 miles from Iskenderun, Turkey to Batman); **TECHINT** (205 miles of 4-in. from Bandirma to Eskisehir, Turkey, and 250 miles of 8-in. from Antalya to Eskisehir).

• **Yacimientos Petroliferos Fiscales** (Argentina).

Project: 497 miles from Mendoza to Buenos Aires.

Status: Proposed.

Foreign Natural-Gas Pipelines

• **Andes Pipeline Corp.** (Glenn McCarthy, Inc).

Project: 500 miles of 12-in. from McCarthy's Bolivian concession to the Chile copper-mining area.

Status: Proposed.

Contractor: Will do own work.

• **Attock Oil Co.**

Project: 60 miles of line from Dhulian field to Rawalpindi in West Pakistan.

Status: Planned

• **Cia. Shell de Venezuela.**

Project: 177 miles of 20-in. from La Paz field in the Maracaibo district to the Cardon refinery on Paraguana Peninsula.

Status: Under way.

Contractor: **Williams Brothers Co.**

Completion: 1957.

• **Gaz de France**

Project: 550 miles of 16 to 24-in. from Lacq field, southwestern France, to Paris, plus a 10-in. lateral to Nantes and 12 to 16-in. laterals to Lyons, making a 1,000-mile system.

Status: Right-of-way work under way.

Contractor: French contractors.

Completion: First stage in 1958; complete system in 1960.

• **Petroleos Mexicanos**

Project: 130 miles of 22-in. to parallel a 14-in. line from Reynosa to Monterrey.

• **Sui Gas Transmission Co.**

Project: 217 miles of 16-in. from Sui gas field to Moultan, Pakistan.

Status: Under way; to be extended later to Lahore with branches at Kot Addu, Jhang Magiana, and Montgomery.

Contractors: **Pakistan Constructors,** a joint company of **Morrison-Knudsen** of Boise, Idaho, and **William Press, Ltd.,** of London.

Project: 145-mile line from Sylhet to Dacca, **East Pakistan.**

Status: Under consideration. If approved construction could start December 1958.

• **Technical Office of Hydrocarbon, Ministry of Mines and Petroleum, Government of Venezuela.**

Project: 207 miles of 26-in. from Anaco fields to Caracas.

Status: Under way.

Contractor: **Fulghum Contracting Corp.** will be consultants; **Petrogas, S. A.** will engineer and construct the line.

Completion: Spring 1959.

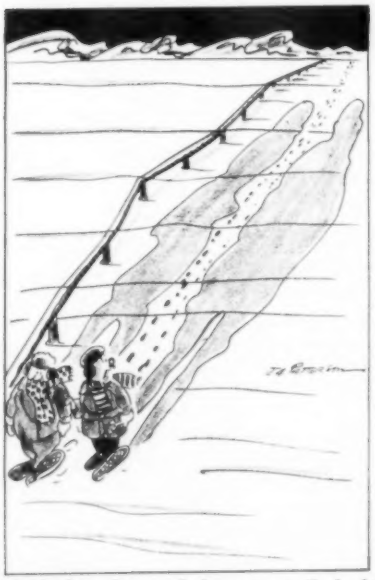
• **Union of Soviet Socialist Republic.**

Project: 808 miles of 26-in. from Stavropol in the Northern Caucasus to Moscow, to serve Voroshilovgrad, Voronezh, Tula, Yelets, and Serpukhov.

• **Yacimientos Petroliferos Fiscales (Argentina)**

Project: 1,056 miles from Campo Duran to Buenos Aires.

Status: Planned.



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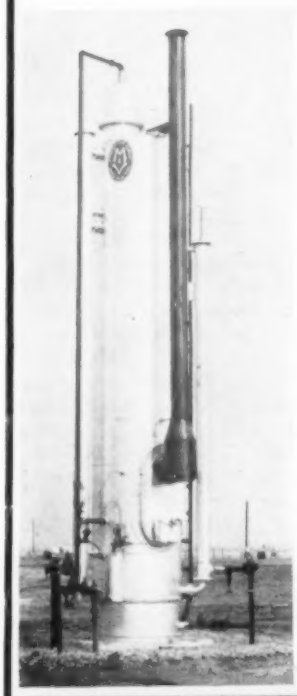

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Among the Drilling Contractors

LEAD UNIT of a four-vehicle convoy carrying a trailer-mounted rig on a 4,000-mile road haul across Australia.

Trailer-Mounted Rig Makes 4,000-Mile Road Haul

A TRAILER-MOUNTED rig being used for contract drilling in western Australia recently completed what is believed to be one of the longest road hauls ever undertaken with this type of equipment.

The haul was approximately 4,000 miles, and took 3 weeks. It began at Brisbane, on the extreme east coast, and followed the coastal route around the south side of the continent through Sydney, Melbourne, Adelaide, Merridan, Mullewa, and Geraldton, to Shark Bay, on the extreme west coast.

From Shark Bay, the rig was ferried to Dirk Hartog Island, where it now is drilling.

Four vehicles made up the convoy. The lead unit carried the draw works, a National T-20 model; the second, the folding mast; the third, the substructure; and the fourth, miscellaneous equipment.

The rig, rated at 200 hp. (input), is owned by Oil Drilling & Exploration, Ltd. Before the move it had been in operation at Longreach, Queensland, where it drilled six tests, totaling 13,153 ft., in 114 days for Longreach Oil Co.

Trimble Drilling Co. is keeping a rig working on a wildcatting program Hodge-Hunt Lumber Co., of Ruston, La., is carrying out on large acreage block in southwestern Jackson Parish, North Louisiana. Its rig now is on its sixth test on Continental Can Co.'s land. Current location, in 3-15n-5w, is about 1¼ miles west of Jonesboro. Last test was dry at 4,337 ft. in the Tuscaloosa.

Sojourner Drilling Corp., Abilene, Tex., is getting down on an 8,500-ft. Morrow test it is drilling for John J. Eisner, also of Abilene, in the south-central part of Hansford County, Texas Panhandle. Location, at 1 Carson, in Section 31, Block R, Brooks & Burleson Survey, is 7 miles south of Spearman. It is about 4½ miles southwest of a Morrow gas-discovery well recently completed by Horison Oil & Gas Co.

Woolf & Magee, Tyler, Tex., will drill a 6,000-ft. Wilcox test for Wedon T. Smith. of Jonesville, La., at a wildcat location southwest of Moro, in Concordia Parish, eastern Louisiana. Location is listed as 1 Compton and others, in 11-7n-7e.

Rowan Drilling Co., Houston, and **Kerr-McGee Oil Industries, Inc.,** Oklahoma City, will be the contractors on two additional wildcats Continental Oil Co. is to drill for C.A.T.C. group in the Gulf of Mexico off the Louisiana coast. Both will be in East Cameron area. Rowan's job is in Block 63 with

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location about 2 miles northwest of Block 62 field, about 20 miles offshore. Kerr-McGee will drill in Block 50, east of Block 49 field, and about 15 miles offshore. Plans call for 12,000 to 12,500-ft. tests.

Lewis Drilling Co., Wichita, is drilling for E. K. Carey Drilling Co., also of Wichita, at the latter's 1 Seacat, a 4,950-ft. Mississippian test 3 miles west of Greensburg, in Kiowa County, southwestern Kansas. Location, in 24-28-19, is a mile west of production in Johansen field.

Pyburn Drilling Co., Shreveport, has a rig working for E. C. Laster, also of Shreveport, on a Rodessa test 10½ miles southeast of Logansport, in De-Soto Parish, Northwest Louisiana. Bottom is expected to be about 5,500 ft. Location, on Laster's Olin Industries lease, in 6-10n-14w, is about 6½ miles southeast of Logansport field, nearest production.

Jett Drilling Co., Inc., Shreveport, has a new wildcat operation under contract for Tensas Parish, northeastern Louisiana. It is to be a Tuscaloosa-Massive test with depth objective about 8,500 ft. Operator is Chicago Mill & Lumber Co., of Houston. Its location is on its own land in 20-12n-10e. This is about 2 miles west of Lake Formosa field, and a little more than 4 miles northeast of North Holly Ridge field.

Woolf & Magee, Tyler, Tex., are getting down on the rank wildcat test they are drilling for J. Willis Hughes, of Jackson, in LaFlore County, northwestern Mississippi. The test, 1 Kearney, in 20-21n-1e, is scheduled to go to 5,000 ft. in the Paleozoics. Location is about 12 miles northwest of Greenwood.

Wilson Drilling Co., Jackson, Miss., has a new contract job in the Gillsburg area, in southeastern Amite County, southern Mississippi. It is a 5,600-ft. Wilcox test for Campbell & Moore, of Detroit, Mich. Location, at 1 Wilson, in 26-1n-62, is a half mile east of the area's single well, a small pumper producing from the deeper Tuscaloosa (Upper Cretaceous) formation.

L. C. Madison is contractor on Texas Eastern Transmission Corp.'s second test on its large block in the Logan area of Cullman County, northern Alabama. It is a cable-tool job with the Knox (Cambro-Ordovician) formation as the objective. Contract is for 3,700 ft. Location is on the Horton land, in 19-10s-4w.

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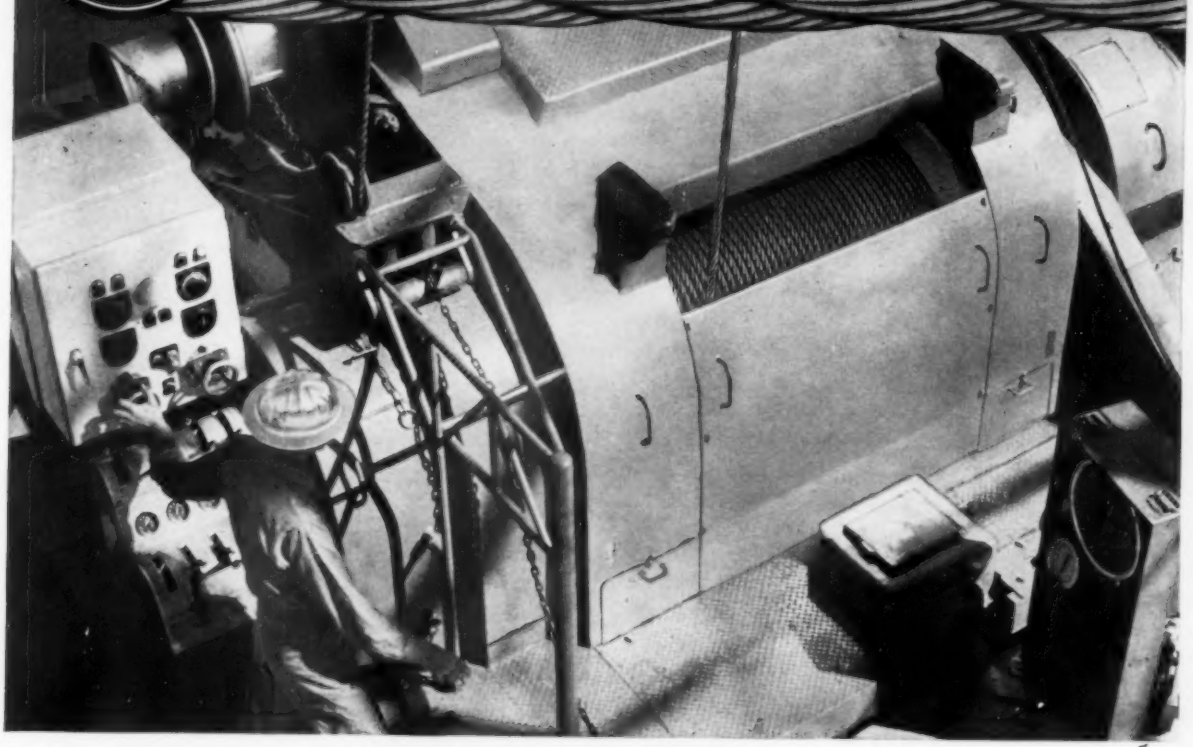

Drill Deeper and Faster with New VHS Rotary Drilling Lines

Drillers in every part of the oil country are proving to themselves the benefits of new VHS Rotary Drilling Lines. Made of a new grade of steel for wire rope, these new VHS lines are 15% stronger than Improved Plow Steel—the strongest available up to now. The new VHS is tougher, too. It gives you many important advantages, including:

Higher Factor of Safety

Careful calculations show that the factor of safety for 10 lines of TRU-LAY VHS rope is 14.9% or 15% higher than for 10 lines of IPS rope. To say it another way, the factor of safety for 12 lines IPS is almost identical to 10 lines of VHS rope. This alone would be reason enough to order VHS rope.

Faster Drilling—Less "Down Time"

With new VHS, you can drill deeper before increasing the number of parts of line. And VHS's extra strength eliminates, in many cases, any necessity for buying new blocks or regrooving sheaves to use larger diameter lines for higher safety factors.

Tougher

Because TRU-LAY VHS is stronger *and* tougher, it has greater resistance to abrasion and higher resistance to peening . . . both important factors in maintaining shape and diameter. Ton-mile advantages should result if regular adaptable cut-off practices are followed.

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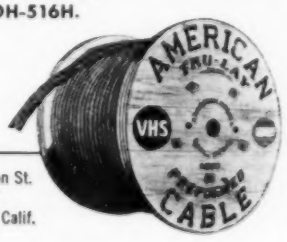

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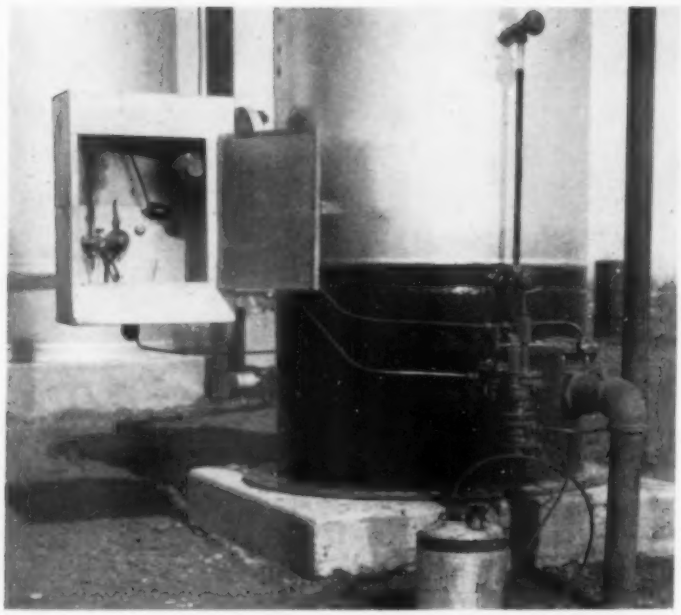

Automatic Sampler for P.D. Meters

From one to 80 spot samples per minute can be obtained from the stream of fluid going through a vessel with this new CEI continual automatic sampler, according to the maker. It is an intermitter type of sampler for use with positive-displacement, dump type of meters, treaters, and similar equipment in automatic lease operation and other purposes.

It is for use primarily in conjunction with Sivalls metering equipment. But it is adaptable to almost all dump type of meters.

The sampler consists of a pneumatic intermitter, sample strainer, sample pump, and sample container. The pump may be adjusted to pump from nothing to .01 oz. per stroke. This feature is said to make it possible to take 20 samples per 1-bbl. dump and yet collect no more than 1 qt. of sample per 1,000 bbl. of oil metered. **Write or call: Sivalls Tanks, Inc., Box 1152, Odessa, Tex., for details on CEI automatic sampler.**

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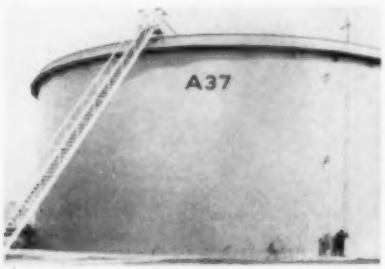

Floating-Roof-Tank Seal Installed Easily

The new patented Nooter two-point suspension seal hanger used on this floating-roof tank is expected to provide greater effectiveness and easier installation and maintenance than ordinary floating-roof seals, according to the manufacturer.

The special seal, a conventional shoe type, is said to provide ease of installation and better radial alignment. Also, the seal hanger exerts a uniform outward pressure over the entire height of the shoe, affording better sealing action and reducing the possibility of abrasion at any one point.

Another feature of the seal is the placement of all of the operating mechanism beneath the roof, thus leaving the roof deck clear.

The Nooter seal is adaptable to the double-deck, pontoon, and pan type of roofs, as well as to any existing type of floating roof. It also can be installed, in a modified shoe design, in existing riveted tanks. There is no size limitation. **Write or call: Nooter Corp., 1400 South Second Street, St. Louis, Mo., for details on new floating-roof-tank seal.**

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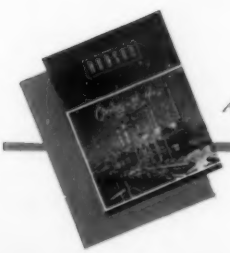
Process cooling in Cosden Petroleum Corporation's new West Texas refining units is largely by direct use of air. Over 250 million BTU's per hour are dissipated directly to five billion standard cubic feet per day of air moved by 38 fans in HUDSON Solo-aire or Combin-aire units.

Solo-aire units are used where low effluent temperatures are unnecessary. Combin-aire units, in which air is first precooled with water, are used where lower effluent stream temperatures are required. The cooled water from the Combin-aires is available for other cooling services; the Combin-aires in this case performing the further function of water cooling towers. Water spray, carryover or condensation is impossible as the effluent hot air is under saturated with water vapor. Combin-aires are installed adjacent to other process equipment.

These Solo-aires and Combin-aires at Cosden, and hundreds of other HUDSON units in oil, gas and chemical processing plants confirm the advantages of cooling with maximum air and minimum water.

Before finalizing design of new process units, let HUDSON assist you in determining optimum balance in use of air and water.



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A special locking device prevents the coupling from turning or slipping within its steel sleeve. It withstands pressures up to 1,100 psi. and remains unaffected by temperatures up to 300° F. the maker says.

Available in sizes from ¾ to 2 in., the coupling may be installed by regular workmen with standard operating procedures. **Write or call: Plastic Engineering & Sales Corp., Box 1037, 2628 St. Louis Avenue, Fort Worth, Tex., for details on insulating couplings.**

●

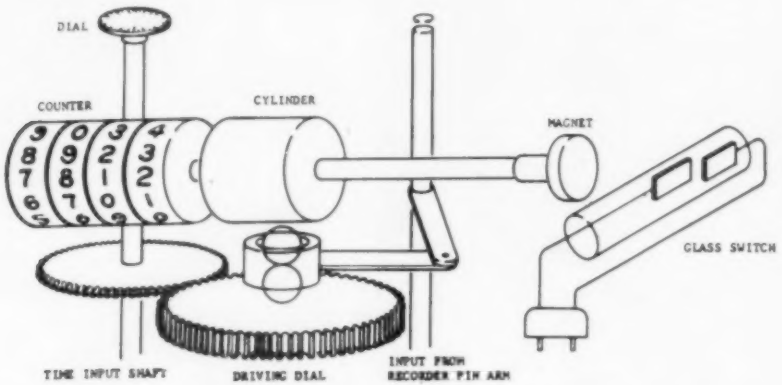
Jet-Perforating System Allows Individual Firing

With this new Selective Rocket Jet perforating system, a number of jet-gun sections of various lengths can be connected and fired individually at the desired perforating zones, according to the maker. The system permits perforating several isolated zones with one run into the hole. A long single zone also can be perforated in a few runs without subjecting the hole to excessive explosive forces.

The system is said to allow gun sections longer than 16 to 20 ft. to be run into the well and limited footage to be fired at one time to reduce shock.

Another feature cited for the new system is that high perforation densities can be provided by reperforating the same zone on one run.

Conventional instruments can be used to check the gun position. Gun sections may be loaded at densities from 1 to 6 per ft. They employ commonly used charges. **Write or call: Western Co., Midland, Tex., for details on Selective Rocket Jets.**



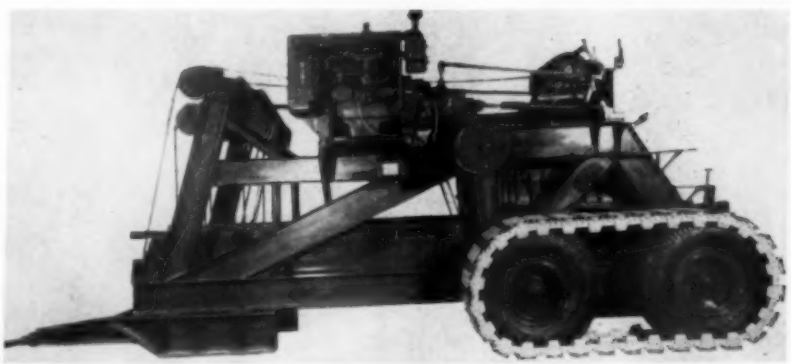
Librascope Offers Continuous Integration

Continuous integration in any instrument or system where integration, area, or average computations and a direct or remote reading is required can be achieved with this new Librascope Model 25 linear integrator, according to the company. The device is a ball-and-disk integrating mechanism, assembled with a counter and output-pulse switch.

The compact device can be adapted to strip-chart recorders of all types and sizes. And it can be used wherever the variable to be integrated or averaged is presented as a shaft position or displacement.

Spring loading of the input linkage is said to eliminate backlash, resulting in immediate response. Because of its low torque requirement, the unit can accept the outputs of sensing elements directly, without the need of servos. The pulse output permits convenient electrical data transmission for use in data systems or with remote counters.

Applications for the computer include flow totalization, averaging of temperature and pressure, and area computation in gas-analysis procedures. **Write or call: Librascope, Inc., 808 Western Avenue, Glendale, Calif., for details on Model 25 integrator.**



Vertical Pipe Bender Travels Highways

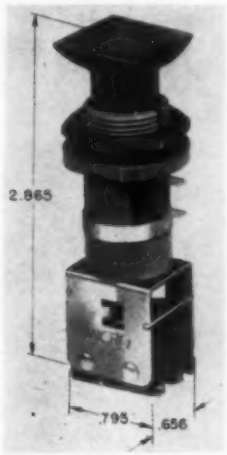
Increased bending power is a feature of this new CRC vertical pipe bender for cross-country pipelines. Though the Model B bender is more powerful than its predecessors, it takes up less room because it is under 8 ft. wide for transporting on highways, the maker reports.

The new tandem-axle pneumatic mounting that is used provides increased mobility. Either rubber tires or Athey tracks are optional. And de-

New Equipment

tachable track pads are available for fitting over the tires. The bender is made in three sizes to handle up to 20, 30, and 36-in. pipe.

The increased bending power is attained by large needle-bearing-mounted cable sheaves and the tilted front mast that gives a strong vertical bend pull. **Write or call: Crutcher - Rolfs - Cummings, Inc., P. O. Box 2073, Houston 1, Tex., for details on Model B pipe bender.**



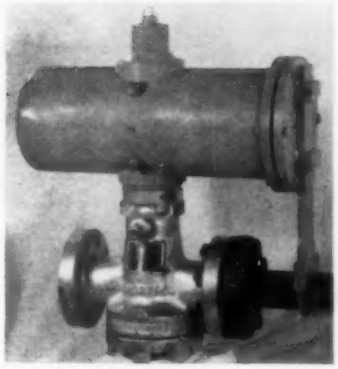
Push-Button Switch Can Save Panel Space

This new lighted push-button switch can be mounted on 1-in. centers, both horizontally and vertically. It requires only 2⅛ in. below its mounting panel. It has snap-action and comparatively high force differential, which helps prevent accidental actuations, the maker reports.

Because it combines an indicator light and a switch in one compact assembly, the lighted push-button switch offers a chance to cut panel-space requirements in half.

In the switch, designated 52PB51-T2, the indicator lamp socket is fastened to the outer body of the switch and does not move when the button is pushed. This is said to increase lamp life, since the lamp is not subjected to shocks from button actuation.

Terminals of the indicator light are separate from those of the switch, allowing the indicator light to operate on any circuit desired. A wide selection of translucent buttons is available, in many sizes, shapes, and colors. **Write or call: Micro Switch Div., Minneapolis Honeywell Regulator Co., Freeport, Ill., for details on Model 52 PB51-T2 lighted push-button switch.**

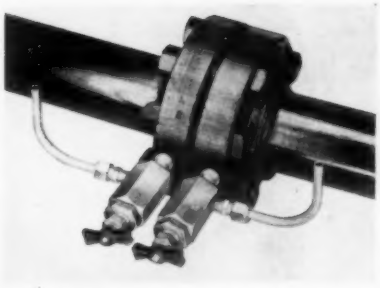


Plug-Valve Actuator Is Easily Attached

This is one of a new series of Robotarm valve actuators. It can be attached to any plug valve in minutes, the maker says.

The actuating stem has a large square recess cast into its base to afford easy adaptation to any plug valve through the use of standard bushings. The actuating stem is hollow to allow extension of the plug-valve lubricator fitting. A universal torque arm for each pipe size is adjustable for height variations.

Two sizes of the actuator are available now—the Series 600, having a piston diameter of 6¾ in. and a torque output of 9,000 in.-lb. with a 150-psi. operating pressure, and the Series 2500 having a 10-in. piston diameter and 35,000-in.-lb. torque output with a 150-psi. pressure. The cylinder shell and end plates are steel. **Write or call: Bettis Corp., 320 South Sixty-sixth Street, Houston, Tex., for details on plug-valve actuators.**



Orifice Flange Valves Are Strong, Compact

On orifice flanges, these Hex valves may prove highly valuable as they can be easily installed side by side to provide a strong and compact installation, the maker reports. The valve body is normally made from solid hexagon Type C 1018 carbon steel to double extra-strong construction.

Made of Type 303 stainless steel, the stems cannot be screwed out until the packing nut is removed. The seat is part of the body. It can be reseated with a simple seating tool under pressure without removing the valve from the line.

End connections for the valves are ½ to ¾ in. N.P.T. Side connections are ¼ or ½ in. Valve packing is of the high-temperature nonlubricated type for a maximum service temperature of 1,200° F.

Besides carbon steel, the valve body is available in Type 304 stainless steel, brass, bronze, monel, or other alloys normally available in hexagon stock. **Write or call: Hex Valve Co., P. O. Box 726, Bellflower, Calif., for details on orifice-flange valves.**

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SHOWCASE . . .

New Literature

Controlled Volume Pumps in Petroleum Refining is the title of new 16-page Bulletin 457. The bulletin, printed in two colors, provides a convenient reference on controlled-volume pumping systems. It includes schematic diagrams and data on actual installations where controlled pumps are used for chemical treating. The installations include catalyst preparation, crude desalting, corrosion control, gasoline treating, inhibitor addition, and water treating. Typical pumps are described at the back of the bulletin. **Write or call: Milton Roy Co., 1300 East Mermaid Lane, Philadelphia 18, Pa., for Bulletin 457.**

●

Air-Operated Automatic Control Equipment. New Publication 159/557 describes the new features of Kent pneumatic-control equipment soon to be available. The equipment is made in England. The data sheet gives the design features on a new controlling unit, reducing valve, air relay, and new instrument panel. **Write or call: George Kent, Ltd., Luton, Bedfordshire, England, for Publication 159/557.**

●

Standard Light Hutting, a four-page technical reprint, describes a lightweight building made in England for semipermanent accommodations in the field. The framework consists of a number of portals placed at 8-ft. centers. Each portal comprises two stanchions and two rafters made from light hot-rolled section, fabricated integral with base plates and with all assembly cleats. The portals are assembled on the ground in two halves and erected without special tools or lifting gear. The metal tiling system comprises everything required to form the complete outer cover for the building. **Write or call: Buckwyn Constructions, Ltd., Hare Hatch, Twyford, Berkshire, England, for reprint, "Standard Light Hutting."**

●

Pneumatic Control Instruments Bulletin A130 (44 pages) features more than 10 pages of general automatic control theory. The two-color bulletin describes, in simplified terms and illustrations, the basic concepts of narrow band, proportional, reset, derivative, and reset plus derivative control actions. It covers selective control, cascade control, and ratio control. The bulletin also includes information on sensing elements for measuring and controlling such variables as temperature, pressure, humidity, flow, density, specific gravity, liquid level, and pH. Schematic diagrams show how the instruments work. **Write or call: Bristol Co., Waterbury 20, Conn., for Bulletin A130.**

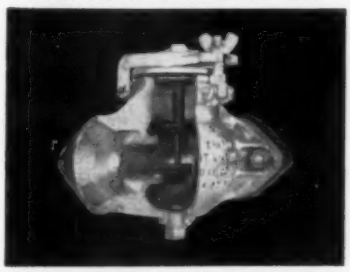
●

Water and Waste-Treating Equipment Bulletin 35-D (20 pages) provides information on Hardinge treating equipment. It includes information on both circular and rectangular clarifiers, automatic backwash sand filters, hydroclassifiers, and flocculating units. Indexed for fast reference, the bulletin illustrates the equipment's applications with photographs and drawings. **Write or call: Hardinge Co., Inc., 240 Arch Street, York, Pa., for Bulletin 35-D.**

●

Power in the Oilfields is the title of this 12-page brochure describing a line of industrial engines and engine-generator sets made in England. The power range of the engines extend from 28 to 270 b.hp. Their applications include powering drilling rigs, pumps, and similar equipment, either directly or through a belt drive. The line includes

Enardo 1900 Series In-Line Vent Valve



Enardo 800 Series In-Line Vent Valve

Are you still looking in the sky for profit losses? Enardo Vent Valves provide a means of keeping a predetermined pressure on stock tanks. These vent valves are used in conjunction with Enardo pressure type hatches. Set 2 to 4 ounces less than hatch pressure to prevent hatch venting.

On leases not using a positive venting system, that have changed to an Enardo Vapor Control System, it has been proven that there was an immediate increase in saleable fluid gravity. For, on a lease with a production of 50 barrels per day, it is possible to add a total savings of $1,482.00 in the books after the installation of proper hatches and vent valves, cutting gravity and volume loss.

Enardo 800 series Vent Valves are offerred in standard 2", 3" and 4" pipe sizes, pressure settings ½ to 16 ounces. Featuring aluminum or semi-steel bodies with plastic trim. Slip-On or flanged ends. Standard valve is 1 ounce pressure, 4/10 ounce vacuum.

Enardo 1900 series Vent Valves also offered in 2", 3" and 4" sizes, with or without companion flanges bolted on. Standard valve 2 ounce pressure, 4/10 ounce vacuum. Pressure settings from 2 to 24 ounces.

Contact the representative nearest you for further information.

Jack Merrill	Harry Higginbotham
Henderson, Texas	Tulsa, Oklahoma
W. R. Lee	K. S. Drane
Midland, Texas	Houston, Texas
Jack D. Neff	Bruce Heller
Ellinwood, Kansas	Tulsa, Oklahoma

ENARDO manufacturing company

BOX 1647 TULSA, OKLA

engines for operation on natural gas and on diesel fuel. **Write or call: Henry Meadows, Ltd., Fallings Park, Wolverhampton, England, for publication, "Power in the Oilfields."**

●

Oil-Well Cementing and Fracturing Equipment (for sale only outside the United States) is described and illustrated in this new 40-page catalog. Its photographs, dimensional drawings, and specifications cover more than 20 models of BJ equipment. These include truck-mounted and skid-mounted high-pressure high-volume pumping units for cementing and fracturing, sand-oil blenders, bulk equipment, conveyors, and cement heads and plugs. **Write or call: Byron Jackson Tools, Inc., 580 Fifth Avenue, Suite 510, New York 36, N. Y., for catalog on overseas cementing and fracturing equipment.**

●

Large-Diameter Propellers for cooling towers and heat exchangers are described and illustrated in new four-page Bulletin 510. The propellers have cast-aluminum blades that permit interchangeability in any assembly and simplify installation and maintenance, the bulletin explains. The hubs are cast-steel with either four or six blades. Available sizes are 14, 16, and 18 ft. in single or multiple pitch. **Write or call: Aerovent Fan Co., Inc., 700 East Ash Street, Piqua 85, Ohio, for details on Almetal propellers.**

●

Mud-Treating Agent for preparation, maintenance, and treatment of gyp muds, called Q-Broxin, is described in this new multicolor four-page data sheet. Besides listing the applications for the mud-treating agent, the data sheet explains its advantages for reducing the gels and viscosity of certain muds, the initial field treatments, and the field maintenance treatments. **Write or call: Baroid Div., National Lead Co., P. O. Box 1675, Houston 1, Tex.**

●

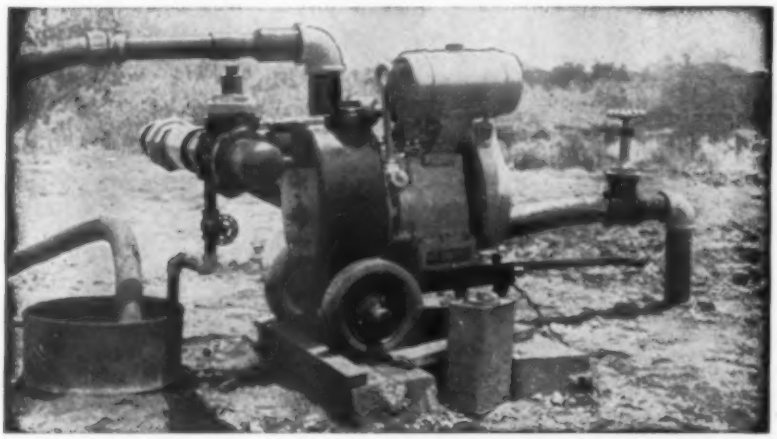
Plug Valves, nonlubricated, steam-jacketed and nonjacketed, available in pipe sizes from 1 to 6 in. are described and pictured in this new three-color, eight-page bulletin. The bulletin describes two versions of the basic internal Atlas full-opening, plug-valve design, the Roto-seal and Twin-seal. Valves using Roto-seal internal parts have either a conventional or jacketed body, while valves equipped with Twin-seal parts have conventional bodies. Cutaway drawings show their operational features and tables give their dimensions. **Write or call: Alco Products, Inc., P. O. Box 1065, Schenectady 5, N. Y., for bulletin on plug valves.**

●

Welding Fittings for nominal pipe sizes from 1 to 16 in., made in England, are the subject of this new pocket-sized foldout. It gives the available materials, sizes, and specifications for elbows, returns, tees, caps, welding neck and slip-on flanges, and concentric and eccentric reducers. **Write or call: B.K.L. Alloys, Ltd., Birmingham Factory Centre, Kings Norton, Birmingham 30, England, for foldout on welding fittings.**

●

Plastic Pressure-Sensitive Tapes for protecting pipelines and controlling corrosion are set forth in new four-page Bulletin 118. The bulletin, printed in two colors, furnishes the specifications on both vinyl and polyethylene pressure sensitive tapes for either hand or machine wrapping of pipelines and points out their applications. A handy chart gives coverage for pipe sizes from ½ to 36 in. The bulletin also includes data on vinyl tapes for electrical applications. **Write or call: Rubber & Plastics Compound Co., Inc., 10 Rockefeller Plaza, New York 20, N. Y., for Bulletin 118.**



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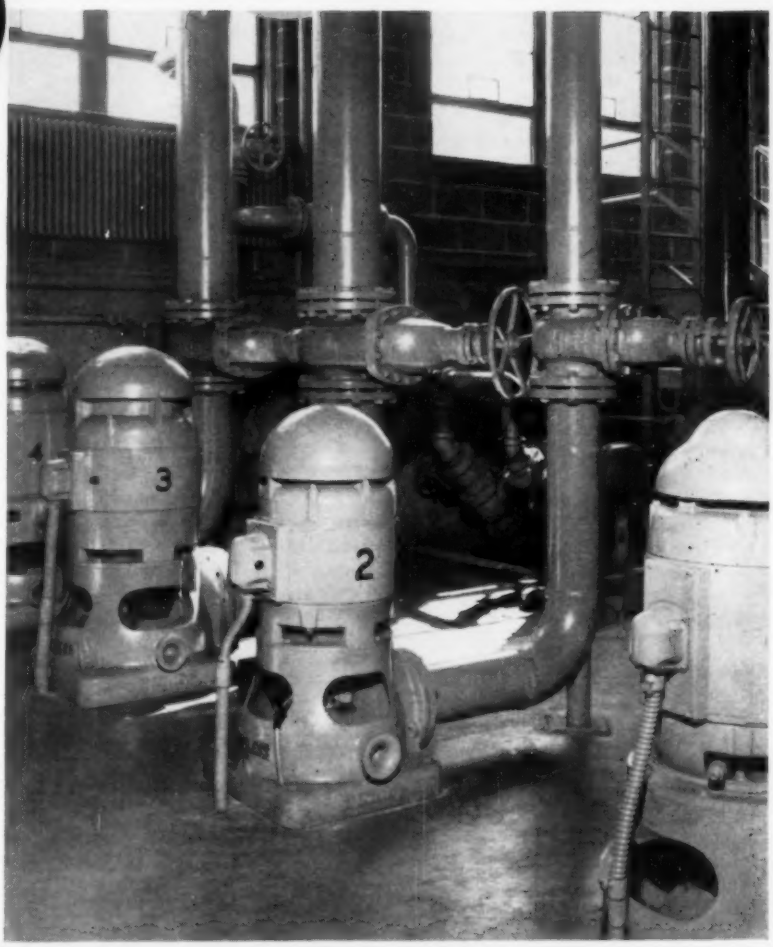

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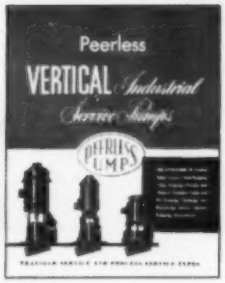

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EQUIPMENT MEN . . . in the News

J. B. Patterson, Continental-Emsco district manager; R. L. Collier, division manager; Earl Cosper, superintendent, Skelly Oil Co.; F. I. Brinegar, executive vice president of Continental-Emsco; and Bill Evans, store manager, discuss opening events of Continental-Emsco's new Farmington store.

Continental-Emsco Opens New Farmington Store

Over 600 men of the industry attended the opening of the latest Continental-Emsco store at Farmington, N. M. The formal opening was held June 15 with over 20 different companies represented.

The new location will serve the San Juan and Paradox basins and other areas around Farmington. Continental-Emsco has had a store in Farmington since 1950 but outgrew the facilities.

Outstanding is the complete D+B pump-shop operation within the building. The 46 by 140-ft. all-steel building has a porcelain enamel front and is the first built to the new standard store design adopted by Continental-Emsco.

Bill Evans has been appointed store manager for the Farmington store and other store personnel include Johnny P. Brewer and J. C. Trowell, field salesmen, and D. M. Butler, sales representative. The Farmington store is in Continental-Emsco's West Texas and New Mexico division and is under the direction of R. L. Collier, division manager.

National Tank Subsidiary Established in California

National Sales Co., a subsidiary of National Tank Co., Tulsa, has been established in California, replacing American Pipe & Supply Co. as a sales agency, according to Jay P. Walker, National president. The new sales arrangement has been established to handle sales, service and customer relationships directly with customers, Walker stated. Personnel of National Sales Co. will be former employes of National Tank.

Enardo Transfers Heller

Bruce Heller, sales representative of Enardo Manufacturing Co., Tulsa, has been transferred from Carmi, Ill., to Regina, Sask., Canada, according to F. P. Wilemon, Enardo sales manager.

Enardo has a sales office and warehouse in Edmonton, and the company plans to open other Canadian branches soon. Enardo manufactures a wide range of valves, fittings, and other oilfield specialty equipment.

Peerless Pump Names Lundy As General Sales Manager

E. W. LUNDY

Everett W. Lundy has been appointed general sales manager, Peerless Pump Division, Food Machinery & Chemical Corp., Los Angeles and Indianapolis, by G. F. Twist, FMC vice president and Peerless divisional manager. Lundy, previously assistant sales manager for the pump firm, succeeds B. A. Tucker, retired.

Lundy joined the Peerless Pump organization in 1940. He was successively promoted from sales engineer to branch office manager at Phoenix to Pacific district sales manager.

Axelson Names West Texas Factory Representatives

G. E. (Gene) Schneider and B. D. (Bernie) Smith have been appointed factory representatives of the petroleum division for Axelson Manufacturing Co., division of U. S. Industries, Inc.

K. S. Ramey, petroleum division sales manager, announced that both Schneider and Smith will be located in the West Texas area. Smith will represent Axelson in the Snyder area and Schneider in the Odessa area.

Du Rapau Named Assistant To Mize at ETL

JOE J. DU RAPAU

Joe J. Du Rapau has been appointed assistant to D. D. Mize, general manager of Electro-Technical Labs, division of Mandrel Industries, Inc., and vice president of Mandrel. Du Rapau, who has been affiliated with the seismograph manufacturing business for over 9 years, will assist Mize in the sale of Electro-Tech products. Electro-Tech has headquarters in Houston and sales and service outlets in Tulsa and Lafayette, La.

Du Rapau previously was with Robert H. Ray Co. For 6 years he was engaged in the design of exploration seismic equipment for Technical Instruments Co.

F. H. Maloney Appoints McBrien General Sales Mgr.

J. H. McBRIEN

James H. McBrien has been named general sales manager for F. H. Maloney Co., according to General Manager E. E. Eutsler. Maloney designs, manufactures and markets precision rubber, metal and plastic products for the oil industry. Headquarters are in Houston.

McBrien has been active in the field of pipeline corrosion engineering and equipment design connected with the pipeline industry. He is also experienced in pipeline refinery construction

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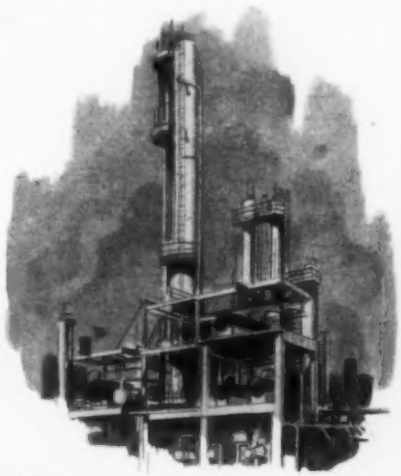
Economy in operation and maintenance is *designed* into Western Heat Exchangers, from drawing board to final fabrication. The production of trouble-free, long-service heat exchangers is of utmost importance for any process application.



Economy is also important in the coking process for producing clean gas oils which are suitable for catalytic cracking. Thus, the design of the furnace is such that a minimum of coke is laid down within the furnace coils; the coke drums usually being operated on a 48-hour cycle, with each drum given 24 hours on-stream, requiring only one dumping crew.

True economy eliminates waste and demands equipment of better quality, designed for longer on-stream time and reduced maintenance. Whatever your process requires in heat exchangers, let Western heat transfer equipment provide economy and greater profits for you.

Western sales-engineering representatives await your call.

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and maintenance. Most recently, he has been Houston branch manager for Midwestern Pipeline Products Co. Prior to that McBrien was a corrosion engineer for Great Lakes Pipeline Co. and sales and service engineer for T. D. Williamson, Inc., and Tod Pazdral.

Bradford Names Wagner to Consulting, Sales Post

H. E. (Mart) Wagner, formerly eastern district manager of Jones & Laughlin Supply Division, has been appointed consultant and sales representative of Bradford Supply Co., Bradford, Pa.

Wagner will continue to headquarter in Pittsburgh, Pa., covering areas in Ohio, West Virginia, and Pennsylvania.

Charles Wheatley Appoints Walker as Sales Engineer

Vernon Walker has recently been appointed as sales engineer by Charles Wheatley Co., manufacturers of Stream-Flo valves. His territory will include all of Oklahoma and the Texas Panhandle.

Walker has been employed as a sales engineer of oil-field equipment for several major companies and as a manufacturer's representative of production equipment.

Cooper-Bessemer Names Wheelock and Bohannan

Richard J. Wheelock has been appointed district manager of the Chicago field office of Cooper-Bessemer Corp., according to Grant C. Woodard, general sales manager. Simultaneously, Donald R. Bohannan has been appointed branch manager. Wheelock fills the district managership of Charles L. White, who retired recently.

R. J. WHEELOCK

D. R. BOHANNAN

As district manager, Wheelock will direct the sales engineering, application, and service of Cooper-Bessemer engines, reciprocating and centrifugal compressors in the North Central district. Working under the direction of Wheelock, Bohannan will assist in the application of Cooper-Bessemer equipment to petroleum, chemical and petrochemical industries.

Before joining Cooper-Bessemer, Wheelock was with Ingersoll-Rand Co. and Climax Engine & Pump Co. Bohannan joined Worthington Corp. in 1937 and was a consulting engineer in 1954, after which he joined Cooper-Bessemer, where he received his advanced compressor engineering training at the main plant in Mount Vernon, Ohio.

Dresser Moves Peebles, Names Two to Sales Posts

H. F. PEEBLES

Henry F. Peebles, general markets district manager of Chicago, has been transferred by Dresser Manufacturing Division to Houston as district manager.

John L. Sullivan has been appointed general markets sales representative for West Virginia and parts of Pennsylvania, Ohio and Kentucky by H. Z. Hight. M. Steven Mossholder has been named general markets sales representative for the Rocky Mountain region.

Before joining Dresser Manufacturing Division in 1950, Peebles was a refining engineer for Magnolia Petroleum Co. Sullivan was formerly employed by Grinnell Corp. and Hartfield-Healy Supply Co. Mossholder was formerly with Standard Pipe Protection Co. and Colorado Milling & Elevator.

Oilwell Names Assistant District Engineers in La.

Joseph H. Carriere has been appointed an assistant district engineer, machinery and equipment sales and service at Houma, La., for United States Steel Corp.'s Oil Well Supply Division, according to M. F. Jones, Gulf Coast area manager of the division. George E. Niver, Jr., and Charles T. Lathrop, Jr., have been named assistant district engineers, machinery and equipment sales and service, at Harvey, La.

Carriere joined Oilwell in 1956 at Houma. Niver was employed in 1956 as a junior engineer at Houma and Lathrop as a junior engineer at Harvey.

BrakeSol Names Gibbins as Special Representative

R. L. (Bob) Gibbins has been appointed special representative by BrakeSol, Inc., Oklahoma City. Gibbins, who is stationed in Dallas, will contact oil men to acquaint them with the advantages of the use of BrakeSol for control of paraffin. He will also assist in developing proper treating programs.

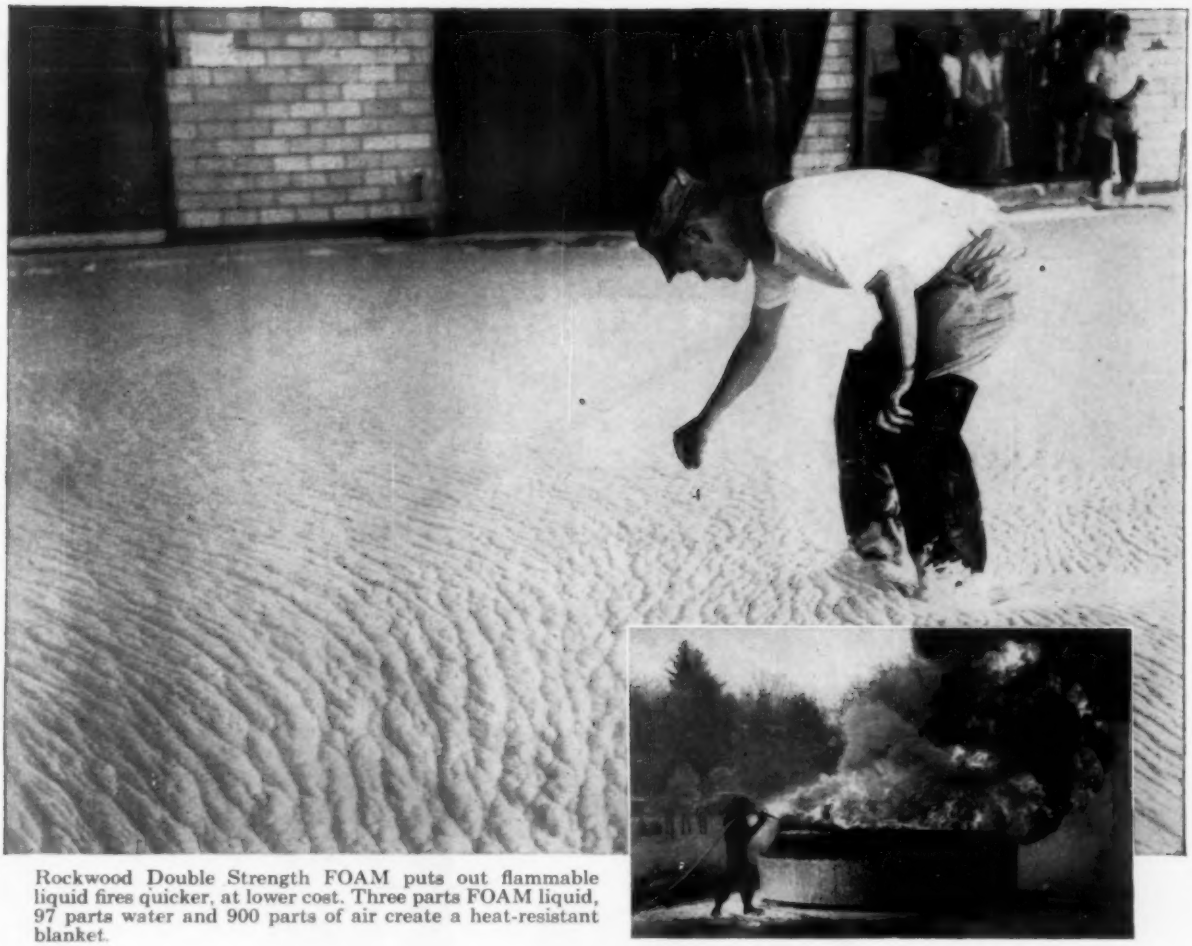
Gibbins was formerly in the sales department of Lone Star Steel for 3 years. Prior to that he was an independent oil operator in Oklahoma City

Japanese Steel Men Visit U. S. Oil Industry Firms

Pictured are Japanese steel firm representatives S. Doi, Fujio Aoki, Isao Seto, Keiji Ikeda and Yasuji Noguchi checking pipeline machinery specifications with John Manley, export sales manager for M. J. Crose Manufacturing Co., at the Crose plant in Tulsa. The Japanese visited Crose as part of a tour of U. S. oil industry supplier plants arranged by Lucey Products Corp. of Tulsa.

Four of the men came to the United States a few weeks ago to study American manufacturing and marketing methods to aid their companies, Nippon Kokan Kabushiki Kaisha (Japanese Steel & Tube Corp.) and Asano Bussan Co. in proposed expansion activities. Noguchi resides in New York as American representative of the Asano company. Not pictured is Y. Ikegami, New York marketing firm representative, who accompanied the group.

Lucey Products has engaged in business with the Japanese firms supplying steel products to the American oil industry since 1952 and was mainly responsible for those companies standardizing production to A.P.I. specifications.



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Rockwood Double Strength FOAM liquid puts out flammable liquid fires quicker at lower cost. Tenacious, fire-smothering bubbles efficiently sweep fire away, and best of all, you pay for only three parts per thousand of the actual extinguishing agent. Three parts of FOAM liquid combine with 97 parts of water and 900 parts of air. The water cost is negligible . . . the air is free . . . obviously the cost of the extinguishing agent must be low.

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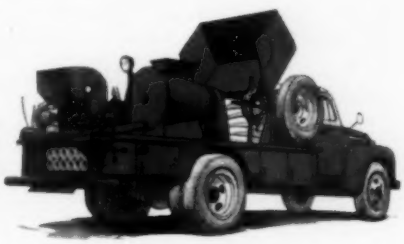
HALLIBURTON'S CHECKLIST OF "STOP-LOSS" TECHNIQUES

	TECHNIQUES	MATERIALS
1	Blocking circulation loss channels with flaky, fibrous, granular or gelling additives to drilling mud or cement.	Flocele (cellulose film flakes) Tuf-Plug (ground and screened walnut shells) Perlites (expanded grains of a lightweight mineral) Howcogel (a high yield bentonite) Palco Seal (redwood fibers for drilling mud)
2	Plugging with quick-setting cements which set up while flowing into and through channels.	Cal-Seal (a quick-setting gypsum cement) Cal-Seal—portland cement mixture Portland cement with accelerator
3	Blocking with special slurry which thickens and sets on contact with water. Waterless slurry is pumped to circulation loss region of well, then hydrated.	Bentonite-Diesel-Oil (BDO) ("Gunk" Squeeze) Diesel Oil Cement (DOC)
4	Squeezing with special material which builds up viscosity until it becomes a stiff gel in the region of loss.	Blox-All
5	Lightening column of drilling fluid or cement slurry to decrease hydrostatic pressure which tends to break down weak formations. This technique may be combined with bulk blocking materials.	Lightweight additives to cement: Pozmix Howcogel (bentonite) Diacel D Expanded Perlites Pozmix 140 — for hot holes

HALLIBURTON'S OPEN-HOLE TREATING PACKER

HALLIBURTON'S OPEN-HOLE TREATING PACKER . . . quickly locates and then treats lost circulation zones in open holes . . . with just one trip into the hole. Can be set, moved and re-set until zone is pinpointed, then blocking agent is placed with same packer. Lengthy anchor is not necessary because Lateral Expanding Slip Assembly makes this unique packer completely independent of the distance from the bottom of the hole.



CEMENTING SERVICES

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and for several years owned a company at Casper, Wyo., which was concerned with cleaning and reconditioning large storage tanks.

Fluor Products Completes Santa Rosa Facilities

Fluor Products Co., division of The Fluor Corp., international engineers and constructors for the petroleum, chemical and power industries, has completed new facilities near Santa Rosa, Calif., for prefabrication of cooling-tower components made of redwood, which is available in the area.

Harrell Joins UOP's Products Department

James E. Harrell, Jr. has joined the staff of Universal Oil Products Co. to represent its products department in technical sales work in the Gulf Coast area. He will also assist refiners in treating, blending, and general refinery problems.

Harrell has had extensive experience in the petroleum refining field. Immediately prior to joining Universal, he was superintendent of the Suntide Refining Co. plant at Corpus Christi, Tex. Earlier he had served as assistant superintendent of Texas City Refinery, Inc., was process engineer for Magnolia Petroleum Co., and worked in the laboratories of Gulf Oil Corp.'s refinery at Port Arthur, Tex.

Beaird Advances Pope and Sims to Key Sales Posts

GERALD POPE

J. R. SIMS

Gerald Pope and J. R. Sims have been advanced to key positions at The J. B. Beaird Co., Inc., Shreveport, La., according to John L. Tullis, vice president of sales.

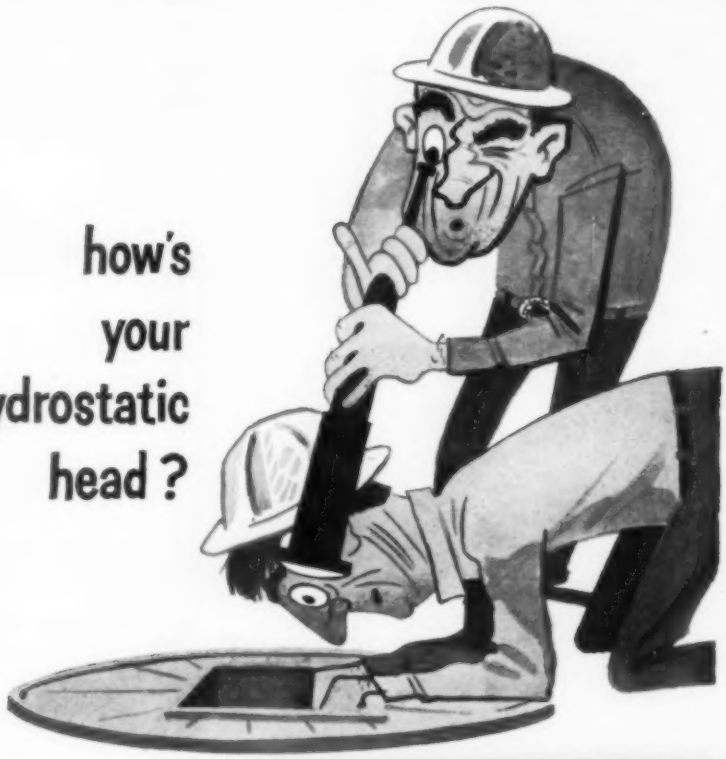
Pope, who has been district sales manager of Beaird's Houston office, succeeds Melvin A. Finuf as assistant general manager of sales. Finuf's promotion to general manager of sales was recently announced. Sims, who has been the compressor division sales engineer in Midland since he joined Beaird in 1955, has been advanced to Houston district sales manager, replacing Pope.

Pope joined Beaird in 1948 as a sales engineer in the Shreveport office, transferred to Houston in 1949, and later was named district manager. Before joining Beaird, Sims had been general manager of Mid State Mapping Service in Shreveport and an engineer for United Gas Pipeline.

Baker Names Clark as Chief Research Engineer

E. H. (Hubie) Clark has been named chief research engineer for Baker Oil Tools, Inc. With Baker for 10 years, Clark has served as assistant chief research engineer for the past 4 years. Holder or coholder of many patents on well-known oil tools, he has also been an active contributor of widely read technical papers.

Clark recently returned from Venezuela where he assisted in the field-testing of a blowout control device he developed from a design conceived by a major international operating company. Previously he had traveled extensively in Canada cooperating with another large operating company in



SEE WHAT'S HAPPENING DOWN THE HOLE WITH Pit-O-Graf

(Records mud pit level)

From the Pit-O-Graf chart you can calculate effectively any loss in hydrostatic head due to gas or salt water incursion. The continuous mud pit level chart warns of blowouts or threatened blowouts and loss of circulation.

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primary cementing research with special emphasis on relieving pressure surges while running pipe.

Sylvester Named to Unify Rockwell, Republic Sales

R. L. SYLVESTER

Russell L. Sylvester, chief engineer of Rockwell Manufacturing Co.'s central valve research and development department, has been promoted to engineering executive assistant of Republic Flow Meters Co. of Chicago, newly acquired Rockwell subsidiary.

Sylvester will assist William F. Crawford, vice president of Rockwell and Republic and president of Edward Valves, Inc., of East Chicago, Ind., who is responsible for coordination of all Rockwell and Republic operations.

Sylvester primarily will coordinate engineering and sales activities of the two companies. As chief engineer of the central valve research and development department, he was responsible for coordinating of development programs at all Rockwell valve plants.

Davison Shifts Petroleum Catalyst Representatives

Joseph Kapp has joined the petroleum catalyst department of Davison Chemical Co., division of W. R. Grace & Co., as a sales representative and has been assigned to the Chicago office. He replaces W. A. Skibbe, Jr., who was transferred to Baltimore headquarters.

Kapp comes to Davison from Phoenix Chemical Laboratories.

U. S. Steel Supply Names Johnson as Tulsa Salesman

Clyde P. Johnson has been named salesman for the United States Steel Supply Division in the Tulsa area, according to Warren F. Hjerpe, manager of sales, St. Louis district warehouse.

Since 1950 Johnson has held both sales and sales management positions in the steel warehousing industry.

Black Becomes Product Sales Engineer for Houdry

E. Newbold Black IV has been named a product sales engineer in the chemical division of Houdry Process Corp., Philadelphia. He was formerly an assistant chemical engineer in the development department of the company's research division at Linwood, Pa.

J&L Transfers Crownover, Names Chisholm Store Mgr.

J. W. Crownover, Jr., formerly Jones & Laughlin Supply Division's store manager at Drayton Valley, Canada, has been transferred to Edmonton to serve as store manager, and William J. Chisholm, formerly a sales representative at Drayton Valley, has been assigned to serve as store manager at that location. These appointments were announced by A. G. Bastian, manager, field sales division.

Crownover joined J&L as a storeman at Seminole, Okla., in 1946. He served as store manager and salesman at Corpus Christi, Tex., and in 1955 was transferred to Drayton Valley as store manager.

Chisholm joined J&L in 1953 as storeman at Stettler, Alta. In 1955 he was promoted to salesman and transferred to Drayton Valley.

Bristol Opens Houston Branch Factory-Repair Lab

The Bristol Co. recently opened a new branch factory and repair laboratory in Houston. The new facility will be under the management of E. A. Merwin, Bristol's district manager in the Houston area since 1945.

IS CASING CORROSION A PROBLEM IN YOUR WELLS?

This case history tells how three companies stopped external casing corrosion on 70 of their oil and gas wells in Western Kansas. It was thought that Dakota water was the cause of most of the corrosion.

The companies called on CSI to survey the wells and determine the current requirements for cathodic protection. These ranged from 0.8 to 3.10 amperes. Then CSI was engaged to complete the job.

Galvomags, Dow's high-potential magnesium anodes, were installed to protect the casing. CSI furnished all engineering, labor, materials and installation equipment, including power augers and ditchers.

The cost averaged $350 per well—for installations designed to give 10 years of protection. The work took 30 days.

Call or write today for engineering or installation help with your corrosion problems—well casing, pipe line, etc. CSI also offers a complete line of quality cathodic protection materials at competitive prices. Estimates or quotations without obligation.

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MOLDING TEST BARS to determine sulfate-resistance qualities. Such quality-control tests, performed under a wide range of simulated bottom-hole conditions, account for Unaflo's consistently better field performance.

Better field performance starts here with quality control of UNAFLO*

- Careful attention to product quality during manufacture of Unaflo Oil-Well Cement pays off in down-the-well dependability.
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- After retarded period, Unaflo hardens normally to form a strong, watertight, sulfate-resistant seal that bonds well with the formation.

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*"UNAFLO" is the registered trademark of the retarded oil-well cement manufactured by Universal Atlas Cement Company

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ALL SIGNS POINT TO PARADOX. These signposts are a typical Four Corners "street" intersection, as operators continue to find new oil reserves in southeastern Utah's Paradox basin.

Utah's Paradox Takes Its Place Among the Big Ones

"It is entirely possible that we are viewing the birth of a new producing province that will rank with any other in the country."

. . . The Oil and Gas Journal, Feb. 27, 1956

By Frank J. Gardner

THE ABOVE forecast appeared in this column on February 27, 1956. It referred to Utah's Paradox basin. At the time, we were chided with the usual "climbing-out-on-a-limb" and "daydreaming geologist" remarks. But in view of events since that time, the Journal's geological staff has plenty of ammunition for its critics. At the time of this prediction, The Texas Co. had just finished the discovery well for Aneth field for 1,704 bbl. per day from the Paradox-Pennsylvanian at 5,828 ft. Fifteen months earlier, Shell Oil Co. had actually opened the first flush production in the Paradox basin at Desert Creek field when its 2 Desert Creek reported a potential of 1,150 bbl. daily. In between the two strikes, little had been done in the way of wildcatting achievement.

Aneth explodes a myth . . . But Aneth exploded the myth that Paradox was a "dry" basin. After its discovery, oil operators swarmed into the region. Less prolific but just as interesting strikes were made at about the same time in the San Juan basin of northwestern New Mexico, and in the past 2 years, the Four Corners region has taken center stage in the national oil hunt. Today, leases are sky-high and scarce. At a Navajo land sale in 1951 and again in 1953, the average lease price was $6 per acre; land in what is now Aneth field itself sold for $30 an acre. At another lease sale in November 1956, the average bid price was $800 per acre, and a 4-section tract adjacent to Aneth went for $3,102 per acre.

Today, at least 41 seismic parties are combing Paradox, representing 20 different operators. Fifty rigs are on the active list in Utah, as these operators pour $1 million a month into the basin. Sixteen fields have been discovered, eight of them since January 1, 1957. And the wildcat success ratio today is roughly 1 out of 5.

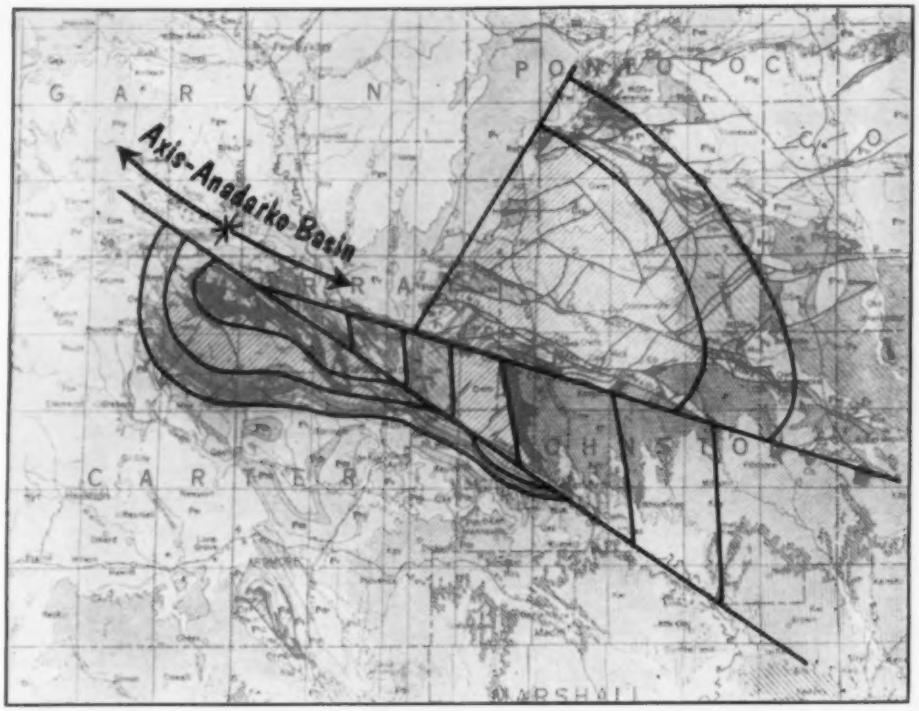
And development gets under way . . . These are expensive operations, but the reserves that are being tapped are well worth the price. The average wildcat well to Paradox pay (6,000 ft. or so) means an outlay of $90,000 to $95,000; if carried deeper to the Devonian, it may mean $110,000. You can hear reserve estimates ranging from the paltry to the astronomical, but a good 300 million barrels for the 16 fields is reasonable. Of this, 200 million is assigned to Aneth alone; in the other fields, not enough development drilling has occurred to make a reliable guess.

This development will not be long in coming, since Four Corners Pipe Line Co. is scheduled to begin taking oil to the West Coast in early 1958. And when development does get under way, the reserves estimates may be expected to undergo drastic quarterly revisions upward. Shell expects to have drilled 100 wells in the basin by April 1958; it has seven rigs whirling now. Carter Oil Co., No. 1 landholder in the region, says, "We will keep at least three rigs busy with development drilling and two working on wildcats through the rest of the year" — this from a company that drilled 15 dusters in Paradox before its first hit early this year. Shell has drilled a total of 15 wildcats in the basin and 6 of them hit.

Now, about 5,000 bbl. a day is being produced and trucked from Paradox. The new pipeline to the west will have an initial capacity of 70,000 bbl. daily and a potential capacity of 160,000 bbl. So Paradox operators have good reason to be optimistic about the future in southeastern Utah and northwestern New Mexico. They'll have no trouble filling that pipeline; and when they do, they'll still be 12,000,000 bbl. a year short of filling the demand on the West Coast.

As Paradox gives the lie . . . We have indeed viewed the birth of a major oil province. And its very existence gives the lie to those who dolefully chant that there are no more "big ones" to be found in this country. It simply isn't so.

Drilling is expensive and geology is complex but . . .



OVER-ALL structural pattern in the Arbuckle Mountains shows complex folding and faulting. This pattern extends into the subsurface and undoubtedly forms innumerable oil traps. Fig. 1.

Arbuckle Region Offers Good Possibilities

By C. A. Caswell

WHY, in view of the published literature, do the Arbuckle Mountains have oil possibilities? This is the first question that most exploration men ask about the Arbuckles. And the answer is so basic to justify an exploration program that it deserves an immediate answer. The Arbuckle Mountains of southern Oklahoma are an undeveloped oil province; all the necessary geologic conditions are present to form oil fields —potential reservoirs, source beds, and innumerable traps, both structural and stratigraphic.

The Arbuckle Mountains have been the subject of almost continuous study and publication by geologists since the first rock hound roamed over the area on foot and horseback. They have long been one of the outstanding outdoor laboratories for field study of the Mid-Continent stratigraphic system. As such they have been visited by geologists from all over the world. For this reason, the published geologic literature abounds with many excellent papers on nearly every aspect of the physical nature of this picturesque bit of terrain tucked away in south-central Oklahoma. And for this same reason, no attempt will be made here to further the purely scientific side of this interesting area. Instead the author will show how this geologic knowledge can be applied by the practical oil man to find new oil reserves in this complex area.

Author is a geological consultant, Oklahoma City, Okla.

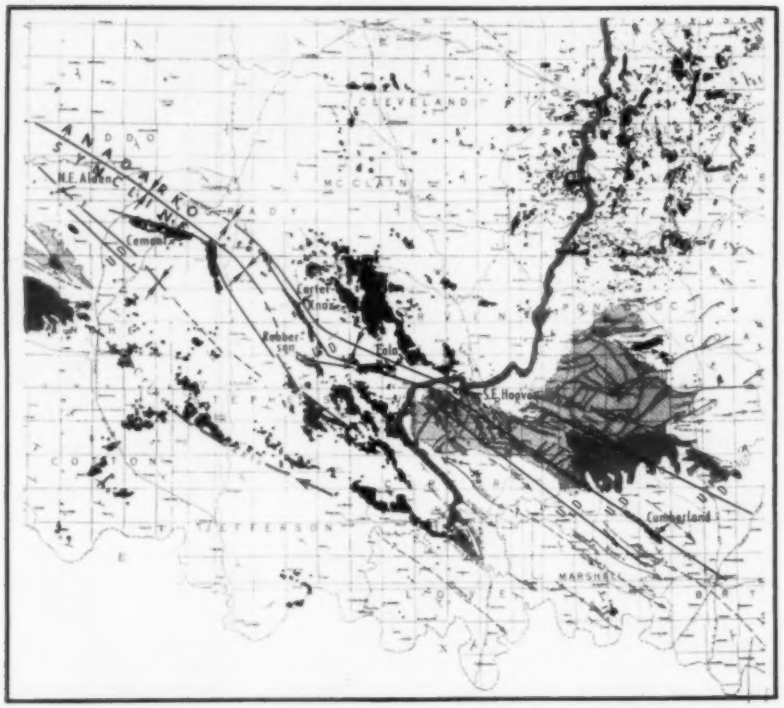
Surface evidence . . . Some of the simple basic practical oil-exploration principles that we can apply to this Arbuckle Mountain province will follow and first thing that must strike our attention is the geomorphology of the area (see Fig. 1). Geomorphology is simply the study of the appearance or form of an area —in short, the relation between topography and geology. Thus we have a literal translation of earth-form science. Although a relatively recent newcomer to the field of petroleum exploration, geomorphology is rapidly proving to be exceedingly useful. For example, the appearance of the Arbuckle province in aerial photos presents a striking application of one of the uses of this method.

Fig. 1 (geomorphic sketch) is a schematic drawing of the over-all relationship of the Tishomingo uplift and the Timbered Hills anticline of the Arbuckle Mountain area. Note the striking relationship of faults and folds to the general alignment of outcrop patterns. Consider for a minute what this implies in terms of possible oil traps. The obvious existence of major structural traps in the area as revealed by this pattern, will force the so-called practical oil man to look further into the area.

Reservoir beds . . . The simple existence of numerous structural traps in an area is not enough to cause us to dash off on a leasing spree. We come then to the second basic principle to be considered in the decision to push an exploration program into a new piece of real estate. Here, another problem arises: Do adequate reservoir beds exist in association with structural traps? Will their presence or absence further harass the dreams of the practical oil finder?

Anadarko Basin Axis

But this ghost is quickly laid to rest (see index map Fig. 2). Here we



THE AXIS of the Anadarko basin lies only a few miles northwest of the Arbuckle Mountains with 20,000 to 30,000 ft. of sediment that contains many prolific oil reservoirs. Fig. 2.

have, only a few short miles from surface granite, one of the thickest potential producing sections in all of Oklahoma. Only 6 miles to the north and west of surface granite, the map shows the axis of the Anadarko basin. And in this basin, there are some 20,000 to 30,000 ft. of sedimentary section that produces prolifically in one horizon or another all over south-central Oklahoma. Here is an area of maximum development of the famous producing Pennsylvanian sands, the Simpson sands, and numerous other important producing horizons, down to, and including the also famous suitcase sand.

This loss of geologic section from the Anadarko basin to the outcrop of the Colbert porphyry illustrates another simple fundamental exploration principle—an area where the updip loss of a favorable stratigraphic section occurs is an excellent spot to look for oil.

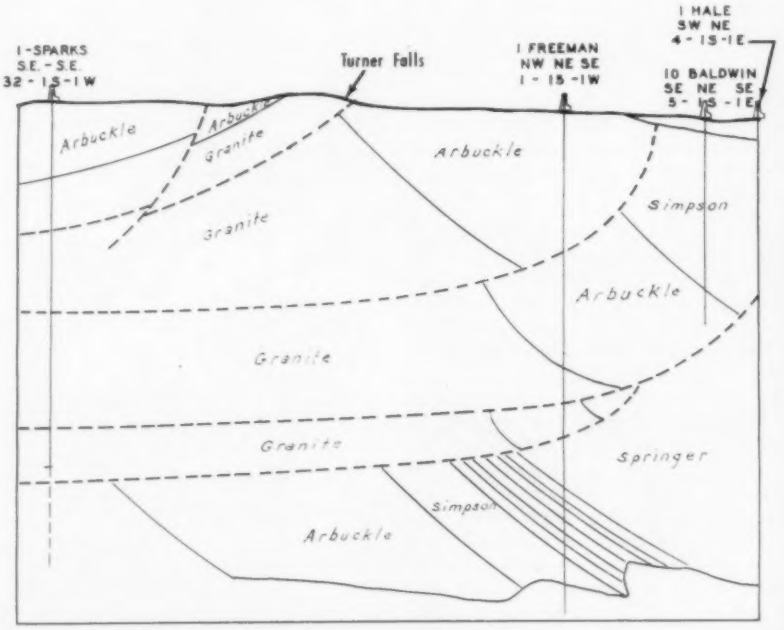
To be practical it makes no difference if that loss is structural or stratigraphic in character. The important thing is that the loss of section, by itself, implies a barrier to oil migration. And of course this is the essence of an oil trap.

If the absent horizons have shown good production histories in nearby oil fields, then they become worthwhile objectives in the new area of trap possibilities. Thus we have the geologic basis for an exploration program in the Arbuckle Mountains, a previously neglected area. We have: (1) evidence of structural deformation, and (2) potentially productive horizons affected by this structural activity.

The specific isolation of these traps requires the continuous careful coordination of geology, geophysics, and drilling. That word drilling should be reemphasized, because in a province as geologically complex as the Arbuckles, the bit is the best exploration tool available.

In this particular province, the probability of finding oil is like the chances of being struck by lightning, and about all geology and geophysics can do in this Arbuckle area now is to get the operator in position where the lightning has a chance at him. In some parts of the province, geophysical work has been very accurate and effective. But only that long lightning rod known as the drill stem can really bring in the fire. However, this happens to be one area where such rank geologic heresy is not quite as nerve-racking to the operator as it would at first appear.

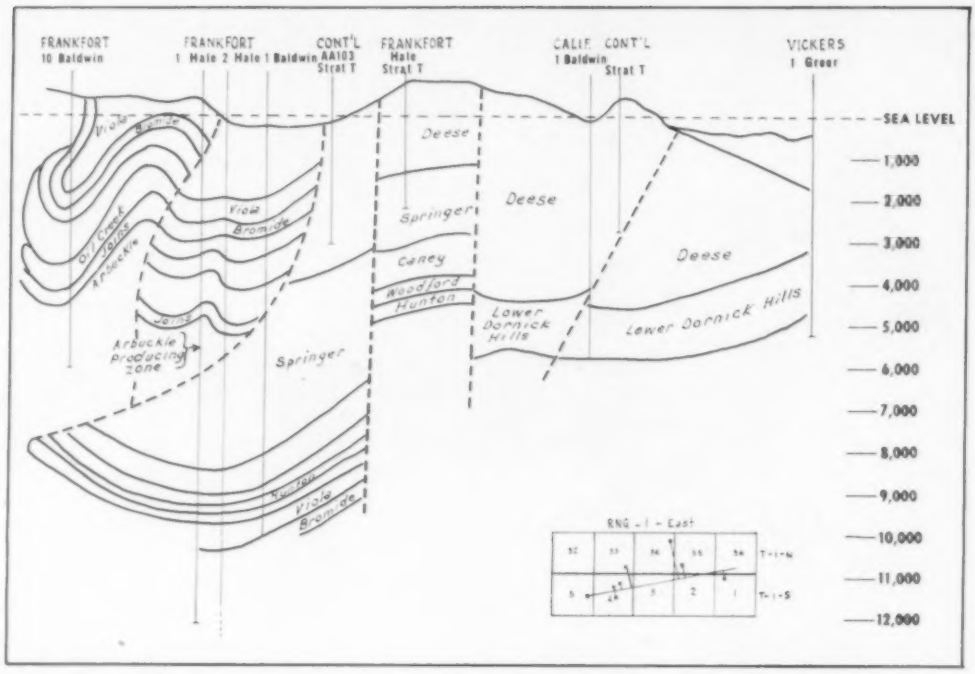
Multitude of oil traps . . . The extreme geologic complexity of this area hinders geologic research. However, by its very nature it creates a multitude of oil traps vertically in a very limited horizontal, or geographic, area. Thus the odds are continually in favor of the drilling well, and this vertical exploration serves to reduce the dry-hole risk. Take as an example the numerous trap possibilities shown in Figs. 4 and 5. In the area shown in Fig. 4, the horizontal distance from the 1 Baldwin to the 2 Hale is less than 1 mile, yet each well penetrated at least one trap not present in the other wells. Commercial production to date has only been above the major thrust-fault zone from the Arbuckle series (5,500 to 6,500 ft.).



ALONG THE FRONT of the Arbuckle Mountains, older rocks have been thrust over younger rocks to form oil traps. Simpson production occurs only 12 miles to the northwest at Eola field. Fig. 3.

But the possibilities of the Pennsylvanian (Deese through Springer) and the Ordovician sand series are apparent readily below the main thrust plane.

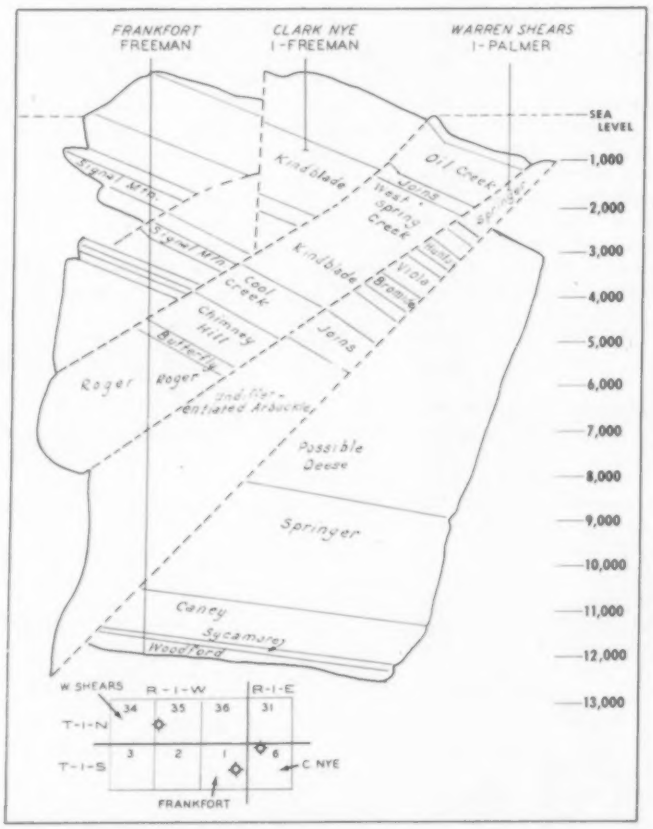
Although the 1 Baldwin penetrated the only Springer sand to date found below the main fault for no show, it did find oil in the lower Viola. While the Viola oil proved to be noncommercial at this depth, it did indicate the major thrust fault provides an effective updip trap where the lower beds abut against the fault. The 2 Hale, while completed in the Arbuckle series above the main fault, did find interesting shows in the Simpson sands penetrated from 11,420 to 13,189 ft. Unfortunately mechanical difficulties prevented getting an adequate test of these zones in this well.



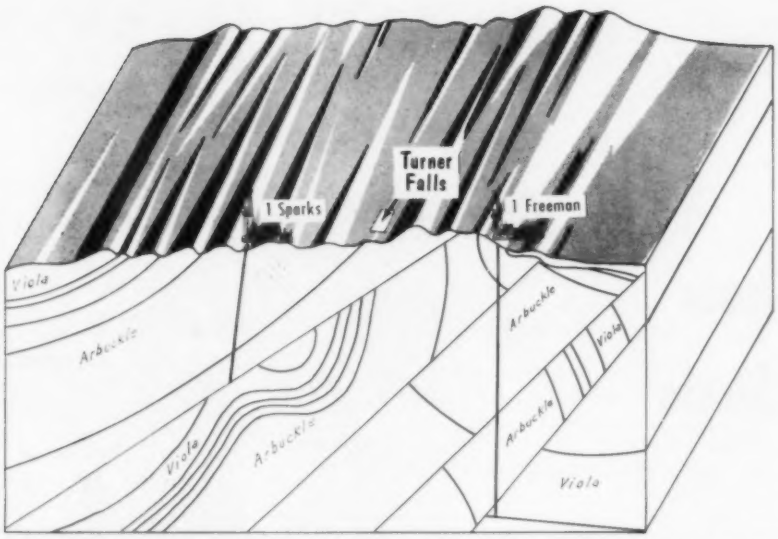
THIS SECTION shows why vertical exploration can be successful along the front of the Arbuckle Mountains. Notice the numerous possibilities for production in each fault block. Fig. 4.

The present production in Southeast Hoover field is from Arbuckle beds trapped against the main northwest-southeast trending thrust fault, and above the fault plane; the producing horizons dip to the south. There are some minor north-south trending faults in the Hale-Baldwin area, but these do not appear to have any effect on the Arbuckle oil trap. Recent wells of Frankfort Oil Co. (namely 10 and 11 Baldwin) tend to verify this conclusion. Thus far, the Simpson potential below the main fault remains inadequately tested.

Simpson potential . . . The existence of Ordovician sand possibilities can be seen in Figs. 4, 5, and 6, in cross-section, and again, structurally, in Fig. 7 by seismic-geologic mapping on the top of the Bromide below the main thrust zone. These possibilities, of course, provide the major attraction of the area. Combined geological and geophysical mapping of this area shows that the major structural trends lead right on west into the Robberson and Eola fields. Here at Eola, where Simpson sand production is associated with thrust fault blocks, estimated recoveries are of an order of 2 to 4 million barrels per well. Reserves like these are more than enough to justify the $750,000 to $1,000,000 completion figures that may be required to tap these reserves.



MAJOR THRUST FAULTS trend northwest-southeast. The Simpson potential (not shown) below the main thrust has not been tested adequately. Fig. 5.



BLOCK DIAGRAM shows the complex folding and faulting common to the Arbuckle Mountains. The main faults are thrust faults and extend northwest and southeast from the mountains into the subsurface. Fig. 6.

Regionally the Ordovician sands are thickening to the southeast in this area. From electric log data, the net effective Ordovician sand thickness was greater in the 2 Hale than it has been in wells of Eola field. So, the recovery aspects of the area are at least as favorable as Eola has proved to be and might even be slightly better.

Commercial production possibilities along the flanks of the Arbuckles occur at depths of 5,000 to 20,000 ft. And there are also numerous instances of shallower low-gravity production within the region. The production from the Kinblade-West Spring Creek sections of the Arbuckle series at the Hale-Baldwin area, officially known as Southeast Hoover field, is becoming more attractive by the day as the producing history of the wells accumulates. New producing zones should be found in the Arbuckle series both above and below the major thrust planes. Bear in mind that the Arbuckle formation, 7,000 ft. thick, represents the thickest untested, potentially productive geologic section in Oklahoma. Furthermore, this Arbuckle Mountain area is one of the most accessible locations available as far as testing the entire geologic section with the drilling bit is concerned.

Fig. 3 shows the regional implications of the data uncovered to date in the area. The section extends from Frankfort Oil Co.'s 1 Hale (NW SW NE 4-15-1e) to Frankfort 1 Freeman (NW NE SE 1-15-1w) to Frankfort 1 Sparks (SE SE 32-15-1w). This schematic sketch gives a possible interpretation of Arbuckle Mountain (Timbered Hills anticline) structural relationships (see also Fig. 6). The sketch is based on a composite of geologic and geophysical information available. The possible horizontal extent of this type of relationship is indicated on the index map (Fig. 2).

Even though highly speculative, this is important to the oil hunter. If even a portion of the Arbuckle Mountains are of thrust-fault origin, then we must extend this tectonic pattern to the northwest and to the southeast. Scraps of evidence throughout the region (see Fig. 2) from the Sinclair 1 Susie (the newly discovered Northeast Alden field), Apache field, to Cement, and on down to Robberson and Eola through Southeast Hoover field on to the southeast through the Cumberland structure, then over to Durant and beyond, indicate that this thrust fault pattern is more extensive than previously thought.

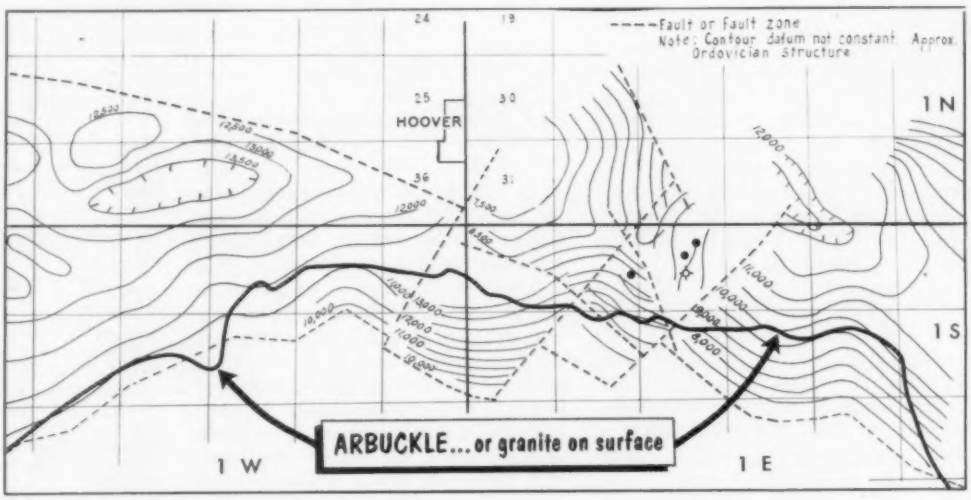
Production data from fields associated with the pattern have, to date, indicated the definite possibility of sizable reserves of the 50,000,000 to 100,000,000-bbl. class in traps associated with the thrust-fault pattern. And the probability that this pattern does exist in the Arbuckle Mountains proper opens up a definite exploration possibility of several hundred square miles in the area between Cumberland on the southeast and Eola on the northwest.

Curiously enough, penetration rates of the Arbuckle formation and granite or igneous rocks drilled to date are actually as fast as Springer shale penetration has been in wells in many parts of southern Oklahoma. Present drilling techniques and equipment have made it feasible, both economically and mechanically, to explore for oil below these major thrust-fault systems.

The recoverable reserves associated with traps of this nature, due to their lateral, vertical, and stratigraphic extent, will undoubtedly provide the stimulus for speeding up the search for such fields soon.

Acknowledgment

The author sincerely appreciates the assistance of John H. Warren, geologist with Frankfort Oil Co., for assisting in the preparation of the cross-sections and the efforts of C. C. Cody, Standard Seismograph Co., who assisted in making the geological and geophysical cross-sections.



Combined seismic and subsurface map shows the Ordovician structure below the main thrust. The three oil wells (Secs. 4 and 5-1s-1e) are producing from the Arbuckle limestone above the thrust fault. Fig. 7.

At Piceance Creek . . .

1,000-Ft. Tests Show New 30-Gal. Oil Shale

By J. R. Donnell

UNTIL recently the Mahogany ledge and adjacent beds in the middle of the Green River formation of Eocene age in northwestern Colorado were thought to be the thickest sequence of rich oil shale in the formation. The Mahogany ledge is exposed in much of northwestern Colorado and northeastern Utah. It is the most persistent and widespread unit in the Green River formation. The Mahogany zone, the subsurface counterpart of the Mahogany ledge, contains a maximum thickness of about 120 ft. of shale that will yield an average of 30 gal. of oil per ton and about 200 ft. of shale that will yield an average of 25 gal. of oil per ton.

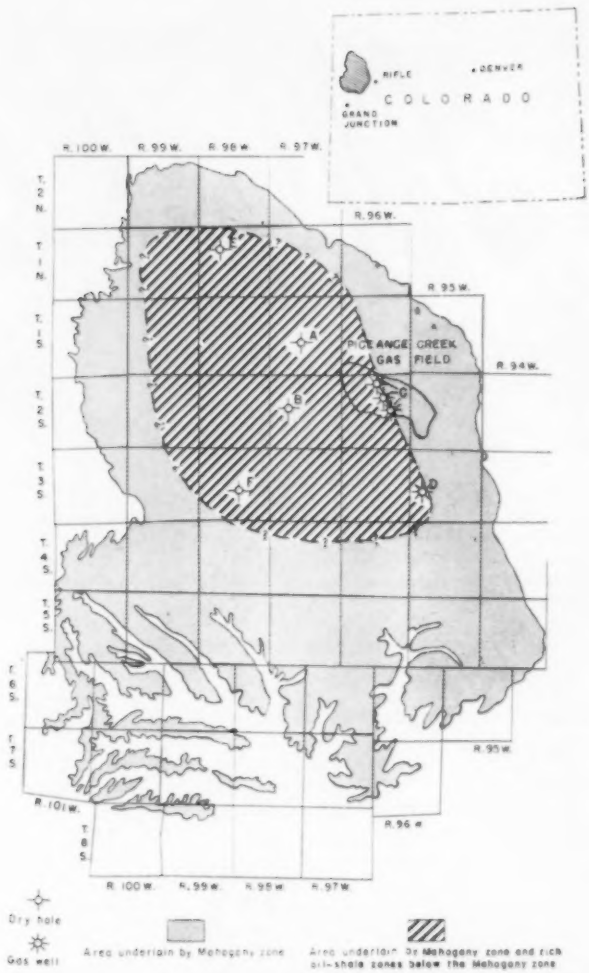
Assays of rotary cuttings of oil shale analyzed by the U. S. Bureau of Mines from oil-company test wells drilled for oil and gas in the western part of the Piceance Creek gas field (Fig. 1) indicated the presence of a considerable thickness of shale. This shale averages 25 and 30 gal. of oil per ton in zones below the Mahogany zone. Initially these deeper zones were thought to be restricted to the vicinity of the Piceance Creek gas field. However, assays of cuttings from recently drilled holes show that the lower zones are much thicker and more extensive than previously suspected. They underlie a much smaller area than the Mahogany zone but include a greater thickness of 25 and 30-gal. shale.

The lower oil-shale zones at well A contain a continuous sequence of shale more than 500 ft. thick that will yield an average of 30 gal. of oil per ton, beginning at a depth of 1,390 ft. This 30-gal. shale is within a continuous sequence of shale more than 1,000 ft. thick that will yield an average of 25 gal. of oil per ton, beginning at a depth of 910 ft.

At well B, the Mahogany zone and the lower oil-shale zones form one continuous unit more than 1,000 ft. thick, beginning at a depth of 540 ft., that will yield an average of 25 gal. of oil per ton. Wells drilled at C and D outline the eastern and southeastern limits, and wells drilled at E and F are near the northwestern and southwestern limits of the lower oil-shale zones. Not enough information is available now to define the western and southern extent of these oil-shale zones.

Thus far the lower zones have not been cored. Assays of core samples from these lower zones would furnish more reliable information on the extent and value of the zones than is at present obtained by the assays of rotary cuttings.

Author is with the USGS. Publication authorized by the director.



SELECTED WELLS PENETRATING LOWER OIL-SHALE ZONES

Well, company, and location—	TD of sampled interval (ft.)
A-51-28-P, General Pet., 28-1s-97w	2,200
B-Brennen No. 1, Equity Oil, 20-2s-9w	4,885
C-22-3-G, General Pet., 3-2s-96w	3,200
84-15-G, General Pet., 15-2s-96w,	2,200
24X-26-G, General Pet., 26-2s-96w	3,340
D-Gardner No. 1, Equiy Oil, 19-3s-95w	2,270
E-64-B-G, General Pet., 8-1n-98w	3,120
F-1 Bois, Equity Oil, 22-3s-98w	4,170

LOWER oil-shale zones are shown on this map. Fig. 1.

References

Donnell, J. R., 1957, Preliminary report on oil-shale resources of Piceance Creek basin, northwestern Colorado: U. S. Geological Sur. Bull. 1042-H, p. 255-271.

Duncan, D. C., and Belser, Carl, 1950, Geology and oil-shale resources of the eastern part of the Piceance Creek basin, Rio Blanco and Garfield counties, Colorado. U. S. Geological Sur. Oil and Gas Investigations OM 119.

EXPLORATION HIGHLIGHTS

APPALACHIAN

OHIO

Marne Oil Pool Extended West

The oil producing area of Marne pool was extended nearly ½ mile west by the completion on 1 T. L. Rubeck, Lot 11, Madison Township, Licking County. The operator, Pennoco, Inc., reported the Clinton at 2,560-92 ft. with a gage of 3 bbl. natural and 100 bbl. in 24 hours after fracture.

● Ohio Fuel Co. 1 S. A. Kline, Section 22, Knox Township, Holmes County, the first offset to the 1- Peterson, logged the Clinton at 3,182-3,215 ft. with an open flow of 1,150,000 cu. ft. natural and 6,300,000 cu. ft. after fracture.

● A second well in central Washington Township, Coshocton County, confirmed a gas pool. Ohio Fuel Co. 2 E. A. Fry, Section 12, with Clinton sand at 3,343 to 3,408 ft. gaged 1,690,000 cu. ft. natural from two pays.

New Wayne County Pool May Be a Major One

The new Franklin pool in Franklin Township, Wayne County, now looks as though it will be a major Ohio pool. The 1 Hosteller in Section 22, ½ mile south of present production and the 1 Hoy, Section 10, ½ mile north of production, have been drilled in with very good showings. Preston Oil Co. 1 C. H. Taylor, Section 15, a south offset to the 1 Miller, logged the Clinton at 3,506-63 ft. with 40 bbl. natural and gaged 400 bbl. oil and 500,000 cu. ft. gas after fracture.

● Ohio Fuel Co. 1 L. C. Kollert, Lot 8, Wadsworth Township, Medina County, a wildcat, found a small gas showing in the Clinton at 3,444-65 ft. after fracture, the test gaged 365,000 cu. ft. gas with a small amount of oil.

PENNSYLVANIA

Mount Pleasant Township, Westmoreland County, Southwest Pennsylvania, Peoples Natural Gas Co. 4123 Carl Shultz is drilling at 6,730 ft. No. 4144 R. W. Dillon is rigging up.

WEST VIRGINIA

Dual Zone Gas Well Found in Logan

In Logan district, Logan County, West Virginia, Carnegie Natural Gas Co. 15-1700 U. S. Steel Corp., elevation 1,586 ft., was unsuccessful in the Big Lime 2,841-3,160 ft., and Berea at 3,783 ft., the two major producing formations in this field. It is now drilling in the Brown shale and a deep test is to be made to the Corniferous lime and if not productive it may go to the Oriskany. This well is on the Gilbert Quadrangle 0.20 mile south of latitude 37 degrees 40 minutes and 4.18 miles west of longitude 81 degrees 50 minutes.

● Williamsburg district, Greenbrier County, Columbian Carbon Co. 1-1235 Pattie Beavers, after a long fishing job at 4,865 ft., filled back to 3,490 ft., and is now drilling in the new hole at 3,609 ft.

EASTERN KENTUCKY

In the Pike County sector of Big Sandy gas field and located on Bridge Branch of Long Fork, Kentucky West Virginia Gas Co. has completed 6387 James Elkins as a gas producer from the Pennsylvanian Salt sand formation. Sand, topped at 1,710 ft. and penetrated to a total depth of 1,729 ft., yielded gas at the rate of 3,356,000 cu. ft. daily. Well was brought in naturally and showed 210-psi. rock pressure in 30 hours.

ARKANSAS

June Discovery Report

Exploration and development in Arkansas during June came up with two new oil pay discoveries, one new gas field, and a major gas field extension strike.

Walnut Hill . . . Gulf Oil Corp. opened Walnut Hill field 2¼ miles west of the town of Bradley in southern Lafayette County, then confirmed it. The 1 Maryman, N½ NW NE 16-19s-25w, 1 mile west of Walnut Hill, made 114 bbl. of oil and 13 bbl. of water per day from the Mitchell sand of the Rodessa at 5,833-37 ft.

New Christmas pay . . . C. A. Lee opened a new pay zone in Miller County's Christmas field at 1 Leo Bryant, SE SE NE 17-16s-26w. The well pumped 20 bbl. of oil and 100 bbl. of water per day from Sturgis sand (fourth) pay in the Paluxy at 3,258-61 ft.

New West Willisville pay . . . N. B. Hunt opened Nacatoch production at A-1 Silvey in NW SW NE 24-14s-22w, West Willisville field, Nevada County. The well pumped 38 bbl. of oil per day from shallow perforations at 1,208-16 ft. Production across the faultline in this field is Tokio.

Aetna field extended . . . Franklin County's Aetna field was extended by Athletic Mining & Smelting Co. at 1 Harry Robberson, C NW NW NE 13-8n-27w, 2⅛ miles east of the field itself. Production was 3,000 M.c.f. of gas per day from perforations in the Barton sand of Atoka at 5,116-64 ft.

New Moreland pay . . . Carter Oil Co. 1 Homer Eakin Unit, C SE NE SW 2-8n-19w, is a new pay discovery well in Moreland field, Pope County. Well flowed 2,820 M.c.f. of gas per day from open hole at 4,157-92 ft. in the Barton. The well is the east offset to the state's biggest gas well and is on the northeast side of field production.

CALIFORNIA

Sunray Adds Gatchell Zone Well to Guijarral Hills

Sunray Mid-Continent Oil Co. has completed the E 54-34 Allison as an oil producer in Guijarral Hills field of Fresno County.

The well tested at the rate of 971 bbl. of oil a day through a 36/64-in. choke following perforations from 10,241 to 10,346 ft. in the Gatchell zone. Oil gravity was 31.1°, tubing pressure was 450 lb. and casing pressure 1,125 lb. The well tested 1,767,000 cu. ft. of gas for a gas-oil ratio of 1,820. Total depth of the hole was 10,360 ft.

Sunray has two other wells currently drilling in the field. The E 61-34 Allison is currently drilling at 9,540 ft. with an objective of 10,450 ft. and the E 73-34 Allison is drilling at 7,577 ft. with an objective depth of 10,500 ft.

Important Arbuckle Extension

Western Gulf Oil Co. completed an important extension test in the Arbuckle gas field in Colusa County. The operator brought in 1 Arbuckle Unit F

Exploration This Week

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flowing 4,488 M.c.f. daily through a ½-in. choke from an interval at 5,884-5,906 ft. This well is located ½ mile east of 1 Arbuckle Unit E Western Gulf completed for 9,761 M.c.f. daily early in June. It is also ½-mile north of the Arbuckle field discovery well in 3-13n-2w.

San Mateo Test Fails

Western Gulf Oil Co. missed with a wildcat located 2 miles west of Union Oil Co.'s Oil Creek field in San Mateo County. Western Gulf took 1 Western Shore to 5,020 ft. before giving up.

Atlantic Gets Big Well at Fillmore

Atlantic Oil Co. joined the list of producers at deep Fillmore field in eastern Ventura County with completion of 1 Pure Gold in SW NE 25-4n-20w. The well was brought in flowing 790 bbl. daily of clean crude through a 16/64-in. choke from two zones. One of the zones is at 13,790-13,840 ft. and the other at 13,940-70 ft. Total depth of the well is 13,990 ft. Atlantic's well is in the townlot area of Fillmore, more than 2 miles east of the original Fillmore field discovery area.

Prado Well Being Abandoned

Riverside County's resign as an oil producing county in California was short-lived as Lyle Garner announced he was preparing to plug and abandon 1 G-G, his Prado Dam field discovery well first completed last February. Sand troubles plagued the well from the start.

CANADA

ALBERTA

Oil Found in D3 At Ponoka Wildcat

The discovery picture was bright in Alberta last week as the Team of Canadian Export Gas Co. and Cree Oil of Canada found oil in the D3 at a wildcat 13 miles east of Ponoka and 115 miles northeast of Calgary . . . Phillips Petroleum Co. found gas at a Whitecourt area wildcat 85 miles west of Edmonton . . . The Canadian Oil-Calgary & Edmonton-Security Freehold team began production tests at the D3 Innisfail reef discovery . . . Hudson's Bay et al. found gas in the D3 at the follow-up well at Pine Creek in the Whitecourt region.

Wood River . . . The Canadian Export Gas et al. wildcat here flowed 50 bbl. of oil per hour on drill-stem test in the D3 formation at the 6-16 Wood River. Earlier this well was a basal Quartz gas discovery.

A series of tests between 5,525 and 5,586 ft. indicated a pay thickness of about 30 ft. The well is being readied for production tests.

Bull Creek . . . Phillips' gas discovery at Whitecourt was made at the 1 Bull Creek, 85 miles northwest of Edmonton and 9 miles southeast of the Whitecourt railpoint. The pay is the Nordegg member of the Jurassic. It gave up a flow of 8,300 M.c.f. of gas per day with distillate. This well is an area of numerous recent gas strikes. Location is on LSD 7-17-59-10w5, 6 miles northeast of previous gas success drilled by Phillips.

Innisfail . . . The important 1-16 Innisfail D3 oil discovery that established 148 ft. of D3 pay flowed more than 500 bbl. per day on initial production tests on 14/64-in. choke. Test was of the 8,498-8,518-ft. zone. On flush flow through tubing after a small acid shot the well gushed at the hourly rate of 200 bbl. Location is on LSD 1, 16-35-1w5.

The three-company team of Hudson's Bay Oil & Gas, Canadian Fina Oil and Pan American Petroleum Corp. that drilled the first discovery well in the Whitecourt region in July of 1955 has since that time had a very great deal of success with both development and exploration work in that region of Central West Alberta. The team holds a spread of more than 1.1 million acres in the general area comprised of 11 adjoining petroleum and natural-gas reservations. The most recent success on this huge acreage spread is situated in the southwest sector of the land block while most of the previous exploration and development has been in the east central portion. The D3 gas pay section was contacted at 11,377 ft. at the Pine Creek No. 11-34 gas well, and a series of drill-stem tests flowed gas at rates up to 10.5 million cubic feet daily. A pay thickness of 75 ft. was indicated. Production casing was being set at last report. This follow-up is 1½ miles southwest of the initial discovery for the team in this area.

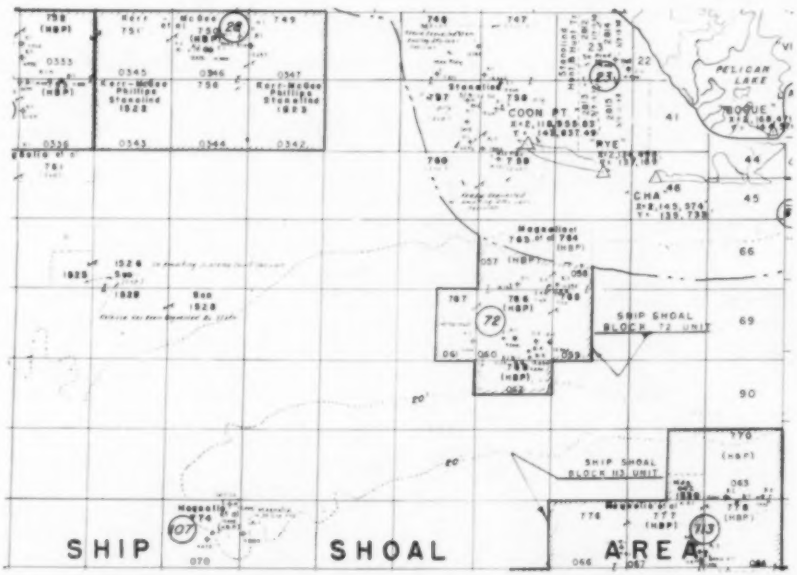
ILLINOIS BASIN

ILLINOIS

One New Oil Pool in Illinois in June

One new oil pool, Corinth in Williamson County, was discovered in Illinois in June. This is the fourth new pool in Williamson County this year out of a total of eight new pools for the state. Only one producing well has been completed so far in each of the new Williamson County pools.

Drilling continued at a low level in



TYPICAL SECTION of the newly completed "Louisiana Offshore Lease Map" offered by A. J. LeVasseur, licensed land surveyor, Sulphur, La. The map covers the entire Louisiana Gulf Coast (offshore areas) in a scale of 1 in. to 3 miles. It is posted currently with lease and well information, showing state and federal leases with their respective expiration dates, oil and gas fields, and wildcat wells. Approximate water depths at 20-ft. intervals are indicated. It is available from LeVasseur or D & H Drafting Service, P.O. Box 243, Lake Charles, La., either on a subscription rate (after purchase of the original copy) with revised copies every 90 days, or with periodical copies supplied as requested.

June. Completions for the month totaled 229, or about 46 per week for a 5-week period. In June a year ago 80 wells per week were completed. Of the 229 wells completed last month, 85 were oil wells and the rest dry holes.

LOUISIANA

SOUTH LOUISIANA

Shoats Creek Outpost Proves Oil Productive

Sunray Mid-Continent Oil Co. is extending production of its Shoats Creek field, in southwestern Beauregard Parish, about a half mile southeast of its discovery well.

Its extension well, 3 Shoats Creek, flowed at the rate of 123 bbl. of oil per day through ⅛-in. choke with pressure of 1,100 psi.

Completion is in Cockfield sand, perforated at 8,964-74 ft. with bottom of hole at 9,200 ft.

This is the third producer for the field. Discovery well, completed in February 1956, was productive of gas and condensate from perforated interval at 8,594-8,614 ft. The second well was oil productive from perforations at 8,988-94 ft.

Two dry holes have been drilled, one a half-mile east of the discovery well, and the other a half-mile west.

Raceland Discovery Opens New Deep Oil Production

Lone Star Producing Co. has opened a new oil-productive area northeast of Raceland, in Lafourche Parish. Its discovery well, 2 Godchaux, is 2½ miles south of Monterey Oil Co.'s Lake Boeuf field, opened last October, and about 3 miles west of the older (1938) Raceland field.

Lone Star's discovery well produced at the rate of 480 bbl. of 37.5°-gravity oil per day through 9/64-in. choke during its potential gage. Flow was with gas-oil ratio of 492 cu. ft. per barrel and pressure of 4,425 psi.

LOCATION of Lone Star Producing Co.'s new oil-discovery well near Raceland, in Lafourche Parish.

Production is from two perforated intervals at 13,389-96 ft. and 13,404-13 ft. Hole had been drilled to 14,171 ft.

Location is southeast of the operator's initial test on the lease block which was abandoned last January after drilling to 13,205 ft.

Monterey has two wells at Lake Boeuf. The first is oil productive at 12,701-12 ft. The second, 2,000 ft. west of the discovery, was completed 2 months ago with gas-condensate production from a slightly deeper sand, perforated at 12,996-13,004 ft.

St. Landry Parish Gets New Oil Field Discovery

Production of Sohio Petroleum Co.'s new discovery well 5 miles northeast of Opelousas, in St. Landry Parish, is rated on potential tests as good for 360 bbl. of 45.7°-gravity oil per day, flowing through ⅛-in. choke.

Through this choke, flowing pressure is 2,600 psi. Gas-oil ratio is 3,060 cu. ft. per barrel.

The well, drilled to 11,354 ft., is productive at 9,964-70 ft., opposite perforations in casing run to 10,200 ft.

Nearest production is about 3½ miles southwest on the north side of Opelousas field. The southeast end of Washington field is about 4 miles north.

MICHIGAN

More Limits to Overisel Pool Established

The Taggart Co. appeared to have established another portion of the east-southeast edge of the Overisel Salina gas pool, Overisel Township, Allegan County. Current failure, fourth duster out of over thirty 160-acre spaced gas tests drilled in the pool, was at the 1 Sal-Nykamp-Branderhorst, C SW 23-4n-14w. Well was bottomed out dry in Salina at 2,805 ft., total depth. Water only was recovered on a drill-stem test run between 2,770-2,805 ft. This failure is offset by producible gas wells to the west and to the north.

First deeper horizon oil well in Walker Traverse pool, Ottawa County, was showing for about 8 bbl. of oil a day following acid and on the pump at Fisher-McCall Oil & Gas, Inc., 1 Mackus, SE NE NW 2-6n-13w, Georgetown Township, Ottawa County. Well is being produced from dolomite pay logged at 2,132-44 ft. Well, an original Traverse oil producer, was deepened from 1,777 ft., original total depth. Exact formation from which new oil is being recovered has not been officially or definitely pegged. Some call it lower Traverse. Others classify it as either Dundee or Detroit River Reed City zone.

OKLAHOMA

Drilling to Step Up During Second Half

Oklahoma oil hunters will step up exploratory and development drilling in the second half of 1957.

During the first 6 months the number of wildcats completed was low—but a healthy 20 per cent were successful.

Most of the discoveries occurred in western Oklahoma. Important new reservoirs were tapped in the Panhandle, northwest, southwest and south-central counties. The main targets in the southwest and south-central are the Ordovician sands and in the northwest the Pennsylvanian and Mississippian rocks.

Here's what the second 6 months of 1957 can expect to produce in Oklahoma:

. . . **A continued trend** toward exploration below 15,000 ft.

. . . **Active and successful** exploration in the unproductive northwestern counties.

. . . **Perhaps a banner year** in finding new reserves, despite a drilling slump the first half.

Deep exploration is the trend in Caddo, Grady, and Stephens counties in the southwest. At least 10 wells, drilling or planned, are projected to 15,000 ft. or below. Some may go to record depths of 22,000 ft. and more.

Here are other hot spots to watch from now until 1958:

Kiowa County . . . A big buying spree can be expected in northeast Kiowa County because of Carter Oil Co.'s Simpson-Ordovician discovery between Carnegie and Mountain View on the north flank of the Wichita Mountains.

The wildcat is northwest of famed Northeast Alden (Susie) field, another significant Ordovician strike.

Location of the new well, 1 McDonald, is a highly faulted area between two fault trends a mile apart. It flowed up to 5,700 M.c.f. of gas daily on test at 3,355-3,403 ft. The pay zone appears to be 90 ft. thick.

Woods County . . . More wildcat activity is predicted in eastern Woods County in Northwest Oklahoma.

Amerada Petroleum Corp. brought in another Wilcox sand discovery near Dacoma in the eastern sector. The 1

Krob is in the successful Oakdale area where Amerada tapped a prolific multipay reservoir 2½ years ago.

The area is on the south flank of the Pratt anticline. The 1 Krob flowed 17 bbl. per hour from the second Wilcox sand at 7,060-90 ft.

Harper County . . . The drilling trend in Harper County will continue to move south and east of the Laverne and Stockholm districts.

Recent discoveries in this area, particularly at Southeast Stockholm, have made Harper one of the attractive drilling areas in Oklahoma this year. The northwestern county had only a couple of shut-in fields 1½ years ago.

The latest pre-Permian success is Midwest Petroleum Co.'s 1 Cooper, a Chester - Mississippian gas discovery which flowed 8,000 M.c.f. per day. Shell Oil Co. also has added to Harper County's drilling prospects with the 1 State discovery, a Chester gas well that made 3,200 M.c.f. of gas daily.

Woodward County . . . Another northwestern county that will bear watching during the rest of 1957 is Woodward. Shell has a rank Chester gas discovery about 18 miles east of any production. The 1 Garvie flowed as much as 2,295 M.c.f. of gas daily from two zones, Chester and Layton. Nearest production is the relatively new Southeast Morrow gas-distillate field near Woodward.

Alfalfa County . . . An active development campaign will continue in Alfalfa County, a north border county. It is one of the state's busiest areas. Sunray, Phillips, Davon, Gulf and Continental are getting into the act. Success is reported in the new Northeast Cherokee field area near Ingersoll. Wells in th new pool flow up to 400 bbl. per day on small choke from sand at about 5,200 ft. They also have good gas flows.

Grant County . . . The Cherokee discoveries in Alfalfa County have affected neighboring Grant County as well. These strikes, coupled with the rapid development of the West Mendon field in the Eureka district, help to round out the northern Oklahoma success story. One of the best new discoveries is Worley & Harrell 1 Gurley, which flowed 10 bbl. of oil per hour from the Cherokee-Pennsylvanian.

Cleveland County . . . More wildcat activity will continue in south-central Oklahoma's Cleveland County, where new multipay fields near Moore and Noble are developing at a fast clip.

Garvin County . . . Testing will go forward in the Ordovician campaign in Garvin County, which has picked up another discovery at Jake Hammon's 1 Mays near Pauls Valley.

Love County . . . A surprise Ordovician discovery in Love County, on Oklahoma's southern border, promises continued development for the rest of the year. The new Southwest Enville field added its first development well last week. The Texas Co.'s 1 Dexter made 85 bbl. of distillate and 1,016 M.c.f. of gas per day from Oil Creek sands. The new discovery area surprised many because the Ordovician wasn't supposed to be there.

McClain County . . . Sunray's 1 Hedrick discovery has perked up activity in the Payne district of McClain County in south-central Oklahoma. The well flowed 28 bbl. of oil hourly from second Bromide-Ordovician sands.

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NORTHERN

Woods County Wilcox Discovery Completed

Amerada Petroleum Corp. completed the Dacoma area Wilcox sand discovery in Woods County. The 1 Krob, NW SE SW 24-25n-13w, flowed 257 bbl. of 37°-gravity oil in 16 hours on ¼-in.

choke from Simpson sand perforations at 7,060-90 ft. This well is on the east side of the county.

NORTHWEST

Rank Harper County Discovery Has High Flow

Midwest Oil Corp. et al 1 Cooper, NE SW 13-25n-22w, 8 miles from production in Harper County, had an open flow gas potential of 25,000 M.c.f. per day from perforations in the Chester-Mississippian at 7,208-26 ft.

This new field is in the southeastern part of Harper County, 8 miles southeast of production in the booming Southeast Stockholm field area. The new exploratory trend in Harper County is to the southeast of the Stockholm area.

ROCKY MOUNTAINS

COLORADO

Weber Strike Hinted at Moffat County Wildcat

The Texas Co. has an indicated Weber-Pennsylvanian oil discovery at 8 Maudlin Gulch in SE SW NE 27-4n-95w, Moffat County. The well recovered 2,210 ft. of free oil on drill-stem test at 8,332-55 ft.

This is the first Weber well on the Maudlin Gulch structure. It is one of many such anticlines in northwestern Colorado where only shallow production has existed for many years. The Maudlin Gulch field is 10 miles northwest of Wilson Creek, at one time the world's highest field. Other fields in the area produce from shallow zones. The trend in northwestern Colorado exploration is moving fast into one of deep Pennsylvanian activity with the Weber being the prime target for the drill.

WYOMING

Willow Creek Discovery Completed in Lincoln County

The discovery well in the Willow Creek unit of southwestern Wyoming has been completed by Pan American Petroleum Corp.

Pan American 1 Willow Creek, located in 3-24n-114w, Lincoln County, flowed 3,600 M.c.f. of gas a day through ¾-in. choke from the basal Ft. Union, topped at 2,366 ft.

Now shut in awaiting a market, the 1 Willow Creek was drilled to a total depth of 2,930 ft., plugged back to 2,531 ft. It is located in the Green River basin area of Wyoming about 10 miles south of La Barge field.

Pan American has 5,469 net acres in the 11,181-acre unit and is operator in the unit.

Campbell Confirmation Swabs Parkman Oil

The confirmation well to a recent Farmers Union Central Exchange Parkman oil discovery in Campbell County swabbed up to 23½ bbl. of oil per hour on tests. The well is Shell Oil Co. 14-18 Edwards in C SW SW 18-49n-75w. This is the east offset.

The Farmers Union discovery pumped 313 bbl. of oil in 21 hours and is still in testing stages. The new producing area is located in the northeastern part of the Powder River basin, and in northeastern Wyoming.

MONTANA

Confirmation Well at Outlook Flows Oil

The confirmation well to Outlook field in Sheridan County, the Williston basin's discovery area of the year, flowed oil at the estimated rate of 13

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bbl. hourly on drill-stem test at 9,063-99 ft. in the Winnipegosis-Devonian, a new pay for the basin. The well is Amerada Petroleum Corp. 1 West, C NE NW 20-36n-53e.

The Devonian was topped at 8,980 ft. and the Silurian at 9,080 ft. This oil is believed to be Devonian but may possibly be from the Silurian via fractures. The 1 West is the northwest extension to Outlook field, a Silurian producer.

NEVADA

Standard Test Going Ahead

Standard Oil Co. of California was drilling ahead below 2,730 ft. on 1 County Line in the White River Valley of White Pine County.

NORTH DAKOTA

Burke County Adds Its Third Oil Field

Burke County now has three oil fields. The latest addition to this producing area which is located between the Nesson anticline and the northeast rim of the Williston basin is Northwest Oil Drilling Co. 1 Bunting, S½ SE SW 5-162n-91w.

The well flowed at the daily rate of 240 bbl. from the Midale zone of Madison at 6,107-14 and 6,117-27 ft. Flow was through 19/64-in. choke. It is located 12 miles northwest of Coteau field and 10 miles southeast of Columbus field.

OREGON

Two Projects Active in Oregon

Sunray Mid-Continent Oil Co. was preparing to move in equipment to drill a wildcat, 1 Kappler, in the Holbrook area of Multnomah County. General Petroleum Corp. was drilling ahead below 1,426 ft. on 1 Long-Bell in Douglas County, Oregon's other wildcat.

TEXAS

EAST TEXAS

Cherokee County Woodbine Project Completed

B. G. Byars, Tyler, has completed his 1 E. M. Decker as a Woodbine discovery in southern Cherokee County. Initial production was at the rate of 60 bbl. of 30°-gravity oil a day, pumping, from open hole at 5,285-88 ft.

Location is 330 ft. from south and east lines of N. Grenshaw Survey, A-182, which is approximately 4 miles west and slightly north of Alto townsite. Nearest Woodbine production is in Fain and William Wise area, 4 miles to the northwest.

Cherokee County also gained two Woodbine wildcats. One was Samedan Oil Corp. 1 Malone W. Armstrong. Location is on a 168-acre tract in Tillman Walters Survey, A-879, 1½ miles northwest of Alto. Projected depth is 5,600 ft.

The other wildcat is Willie Holcomb, to be drilled approximately 5 miles southwest of Rusk townsite, and midway between Woodbine production in South Rusk and Fain fields in central Cherokee County. Location is in the S. Hendon Survey, A-374. Projected depth was 5,400 ft.

TEXAS PANHANDLE

Atoka Discovery Flows Oil in Roberts County

Pan American Petroleum Corp. reports a good show of oil in a Texas Panhandle wildcat well.

The well is the 2 Brainard, located in Section 172, Block C, G&M Survey, Roberts County.

On drill-stem test of the Atoka lime from 7,473-7,546 ft., the well flowed at a rate of 26½ bbl. per hour of medium gravity oil. An additional 31 bbl. of oil were reversed out. Operators are now drilling ahead.

Pan American owns a two-thirds working interest, with Sun Oil Co. having one-third, in the well and in a 12,442-acre block around the well.

WEST TEXAS

Gaines County Wildcats Continue Testing

Signal Oil & Gas Co. 1 Ford, Devonian prospect in southwestern Gaines County, reported flow tests through perforations at 9,170-72 ft. On a 24-hour gage, the well made 46 bbl. of oil through 20/64-in. choke.

Top of the Devonian at 1 Ford was 9,045 ft., minus 5,475 ft. Location is 5 miles southeast of Hobbs, N. M., in Section 25, Block A-10, PSL Survey.

Magnolia Petroleum Co. had a Wolfcamp discovery shaping up at 1 George Norman estate in Section 9, Block C-45, PSL Survey. Location is in southern Gaines County, between North Means (Queen) and Pence (Wolfcamp) fields.

On a test of perforations at 8,149-56, 9,167-73 and 9,180-84 ft., 1 Norman flowed 130 bbl. of oil and 60 bbl. of water in 20 hours. Choke size and flowing pressures were not reported. Pumping equipment was being moved in for further testing.

Previously, 1 Norman recovered free oil from the lower Clear Fork at 7,628-81 ft. Total depth was 12,368 ft.

Crane County . . . Gulf Oil Corp. 265 Waddell, projected 13,200-ft. wildcat 13 miles northwest of Crane, drilled ahead below 8,121 ft. after flowing gas and recovering oil on a 4-hour drill-stem test in the Wolfcamp.

On the test at 7,914-84 ft., gas surfaced in 15 minutes, and recovery was 4,230 ft. of 33°-gravity oil, plus 470 ft. of mud and oil. Maximum flowing pressure was 740 psi. A later test at 7,962-8,024 ft. recovered mud with no shows.

Irion County . . . Sinclair Oil & Gas Co. has asked discovery allowable for its 4 J. R. Scott, in the Ketchum Mountain (Clear Fork) field of central Irion County. Pay section has been identified as the Lower Clear Fork. Perforations at 4,482-4,506 ft. gaged 215 bbl. of 39°-gravity oil a day through 18/64-in. choke. Gas-oil ratio was 617:1 and tubing pressure was 290 psi. Location is NW NE Section 50, Block 14, H&TC Survey.

Pecos County . . . Tidewater Oil Co. 1 White & Baker "B" has been completed as a pumping Strawn discovery. Potential was 221.39 bbl. of oil a day, with no water. Gas-oil ratio was 365:1. This well is located in Section 87, Block 194, GC&SF Survey, which is approximately the center of Walker (Permian) field. It was drilled as an Ellenburger test, to 9,587 ft., total depth, and made final perforations in the Pennsylvanian Strawn at 7,228-7,330 ft. Tidewater has a one-half working interest in 1,394 acres, in an 80-acre checkerboard pattern in the area.

TEXAS GULF COAST

Port Alto Townsite Well Makes Dual Gas Producer

Hugh J. Fitzgerald and Coastal States Gas Producing Co., joint operators, have a new dual-zone gas-condensate producer on the Calhoun county side of Appling field.

It is their 1 Vance, located in the Port Alto townsite, on the east shore of Carancahua Bay.

Producing zones, perforated, were at 8,302-06 ft. and 8,468-74 ft. Flow from the shallower pay was at the rate of 1,470,000 cu. ft. of gas per day through 5/32-in. choke. Shut-in pressure is 2,950 psi. The deeper zone produced at the rate of 1,530,000 cu. ft. per day, also through 5/32-in. choke.

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Large Gas Flow Rewards League City Workover Job

A gas flow at the rate of 185,000,000 cu. ft. per day was gaged during tests of the reworked discovery well of North League City field, Galveston County.

The well was drilled by Gulf Coast Leaseholds, Inc., in 1947, and originally completed as an oil producer in an 8,700-ft. Frio sand. It has been reworked by Sparta Oil Co. and is being recompleted in a lower Frio sand, perforated at 10,004-10 ft.

Liquid (49.4°-gravity condensate) recovery is with a ratio of 10,700 cu. ft. per bbl. This is the first gas production in the field, in which five wells have been completed.

Total depth of this well, located a mile southwest of League City townsite and 1½ miles north of the main League City field, is 10,239 ft.

SOUTHWEST TEXAS

McMullen Edwards Field Gets Confirmation Gasser

Deep Edwards gas production discovered last August by Standard Oil Co. of Texas in its Henry wildcat 5 miles northwest of Tilden, in McMullen County, is being extended about a mile southwest by the same company's second test for the area.

The extension and confirmation test, 1 E. M. Henry Unit 2, tested the deep Edwards in open hole at 11,041-11,209 ft Its flow through 9/32-in. choke was at the rate of 2,274,000 cu. ft. of gas daily with pressure of 1,150 psi.

Edwards in the discovery well was open from 10,549 to 11,060 ft. Through the same sized choke, its flow was 5,054,000 cu. ft. per day with pressure of 2,815 psi. Open-flow potential rating of that well was 40,000,000 cu. ft. of gas per day. Recovery of liquid, 51°-gravity condensate, was 18 bbl. per 1,000,000 cu. ft. Potential gage of the new well has not been taken as this is written.

Standard of Texas has not been so successful in a deep Edwards test 5 miles northeast of the Henry area. There, its 1 Roark, in Section 59, BS&B Survey, is shut down after a series of disappointing tests in several perforated intervals through the Edwards from 10,340 to below 11,000 ft., and in a shallow zone, perforated at 4,909-15 ft.

WASHINGTON

One Washington Wildcat Abandoned

McCulloch Oil Exploration Co. of California has thrown in the towel on 2 Pasquier, a 4,326-ft. wildcat drilled in the Enumclaw area of King County. This left the state with two active drilling projects.

- Utah Consolidated Oil Co. was testing a zone between 4,150-4,080 ft. in 22-1 Swanson at Copalis Beach, Grays Harbor County. Total depth of this well now is 4,599 ft.
- At Rattlesnake Hills in Benton County, Standard Oil Co. of California was drilling ahead below 141 ft. on a wildcat.

Successful Wildcats

ALBERTA

Hudson's Bay et al 1 Flag Lake, LSD 7, 23-41-12w4. Viking oil well. TD 3,440 ft.

SASKATCHEWAN

White Rose Devon Palmer Canadian Superior 1-5 Oxbow, LSD 1, 5-4-1w2. Charles oil well. TD 4,355 ft.

Mobil Woodley-Sinclair X-9-29 East Bellegarde, LSD 9, 29-6-30w1. Mission Canyon oil well. TD 3,326 ft.

Can. Seaboard-Canso Oil 7-12 Fusilier, LSD 7, 12-34-28w3. Blairmore gas well. TD 2,905 ft.

MANITOBA

Sun 11-20 C. Nichol, LSD 11, 20-11-26w1. Mississippian oil well. TD 2,125 ft.

NEBRASKA

Banner County: Sunray-Mid-Continent Petroleum Corp. et al 1 Herbert Peterson, C SE SE 12-18n-57w. IPP 148 BOPD, "J" sand discovery, new field. TD 6,550 ft. "J" sand.

Scotts Bluff County: Tom Vessels, Jr. et al 1 State "A," C SW SW 26-21n-56w. IPP 109 BOPD, "J" sand discovery, first production in county. TD 5,706 ft. "J" sand.

NORTHWEST NEW MEXICO

San Juan County: H. L. Fannin, Jr. 1 Vanderslice, C SW SW 13-25n-12w. IPP 5 BOPD, Gallup discovery, new field. TD 4,535 ft. Lower Gallup.

COLORADO

Adams County: J. Glenn Johnson et al 1 Anderson-State, C SW SW 16-2s-65w. IPF 28 BOPD, "J" sand discovery, new field. TD 8,400 ft. "J" sand.

La Plata County: Murchison Trusts 1-13 Blk. 16, NE 13-32n-9w. IP 3,400 M.c.f. of gas per day, Mesaverde discovery, new field. TD 6,550 ft. Mancos.

WYOMING

Campbell County: Farmers Union Central Exchange 1 Ferguson-Government, W½ SE SE 13-49n-76w. IPP 329 BOPD, 58 BS&W. Parkman discovery, new field. TD 7,199 ft. Parkman.

Lincoln County: Pan American 1 Unit, C Lot 12, NE NE 3-24n-114w. IP 3,600 M.c.f. of gas per day, ¾-in. choke, lower Fort Union discovery, new field TD 3,010 ft. Hilliard.

Natrona County: Quality Oil Co. 4 Government, NE NE NW 1-36n-82w. IPF 5 BOPD from Crow Mountain and 34 BOPD from Tensleep. Dual completion. Crow Mountain new-pay discovery. TD 3,224 ft. Tensleep.

SOUTH LOUISIANA

Jefferson Davis Parish: Magnolia Petroleum Co. 1 Hawthorne, 2-11s-4w. IP 55.9 BOPD (net), 13 per cent b.s. & w., 3,950 M.c.f. daily, 3/16-in., 45.7°, perforations 14,865-75 ft. TD 10,005 ft. (New pay in Lake Arthur field.)

Lafourche Parish: California Co. 2 C. F. Bailey et al, 60-17s-21e. IP 171 BOPD, 9/64-in., 31.4°, GOR 444 cu. ft. per bbl., perforations 11,180-11,200 ft. TD 12,774 ft. (New pay in Cut Off field.)

St. Mary Parish: Jett Drilling Co. and Southern Natural Gas Co. 1 St. Mary Bank & Trust Co., 39-15s-12e. IP 262 BOPD, 5/32-in., 39.5°, GOR 1,932 cu. ft. per bbl., perforations 12,231-38 ft., and (dual completion) 120 BOPD, ¼-in., GLR 12.4 M.c.f. per bbl., 55.3°, perforations 12,150-54 ft. TD 14,082 ft. (New field—1½ miles southeast of Patterson field.)

Terrebonne Parish: Shell Oil Co. 1-A Peters, 64-18s-18e (2½ miles northeast of South Houma field). IP 141 BOPD, 3,668 M.c.f. daily, 3/16-in., 49.4°, TD 4,050 ft., perforations 11,282-11,306 ft. TD 12,835 ft. (New field.)

WEST CENTRAL TEXAS

Coleman County: Davis & Davis, Inc., 2 James R. Moore, Sec. 1, GH&H Sur., 4 mi. SE Coleman. IP 33.6 BOPD, 18/64-in., 42°-gravity, GOR 220, TP 75 psi., Fry 2,077-85 ft. TD 2,220 ft.

Haskell County: B. A. Duffy 1 Ashley, 31-1-H&TC, 3 miles NW Haskell, IP 136 BOPD, 16/64-in., 42-gravity, GOR 485, TP 140 psi., Caddo 5,379-96 ft. TD 5,510 ft.

Sojourner Drilling Corp. and David M. Grubbs 1-D Robertson, 90-1-H&TC, 3½ mi. NW Stamford. IPP 84 BOPD, 41-gravity, GOR 138, King sand 2,935-45 ft. TD 2,945 ft.

Shackelford County: Reynolds, Kirk & Neeb 2 Dwell Newell, 11-14-T&P, 7 mi. W Albany. IPP 112 BOPD, 38-gravity, GOR 800, Cook sand 1,351-62 ft. TD 1,362 ft.

Stephens County: Ira Lee Drilling Co., Inc., 2 Sayle, Sec. 1265, TE&L Sur., 5½ mi. NW Breckenridge. IP 48.6 BOPD, 12/64-in. 42-gravity, GOR 200, TP 120 psi., pay 2,337 ft. TD 2,342 ft.

NORTH TEXAS

Archer County: Frankfort Oil Co. 1 Lyles, Sec. 7, Hooper & Wade Sur., A-234, 5 mi. S Mankins. IPP 96 BOPD, 41-gravity, GOR 400, Strawn 3,900-08 ft. TD 5,314 ft.

Baylor County: M. J. Frances 1 Braxton, 5-1-D&W, 2½ mi. SE Bomarton. IPP 12 BOPD, 36-gravity, Tannehill 1,490-96 ft. TD 1,564 ft.

Knox County: Katz Oil Co. 1 Walker, 70-13-H&TC, 10 mi. NW Knox City. IPP 106 BOPD, 37-gravity, Strawn 5,322-26 ft. TD 5,861 ft.

Wilbarger County: British-American Oil Producing Co. 1 Wilkinson, Sec. 103, Wagoner Colony Subd. Sur., 12 mi. NE Harrold, Strawn lime discovery in Bugscuffle field. IPP 110.6 BOPD, 36-gravity, GOR 195, perforations 4,422-32 ft. TD 6,360 ft.

Young County: Wesley Stephens and K. J. Rich 1 Mahaney, E. J. Ribble Sur., A-1353, 10 mi. S Graham. IP 313 BOPD, 12/64-in., 41°-gravity, GOR 400, TP 140 psi., Strawn 2,195-99 ft. TD 2,240 ft.

Oil man will head A.I.M.E.

. . . Monterey's Pyle Nominated

HOWARD C. PYLE, president of Monterey Oil Co., has been nominated as the 1959 president of the American Institute of Mining, Metallurgical, and Petroleum Engineers.

Nomination was presented by the Society of Petroleum Engineers branch of A.I.M.E., the unit designated to nominate the 1959 president. Pyle will serve during 1958 as president-elect of A.I.M.E. before assuming the top job.

Under A.I.M.E. by-laws if no alternate nominations are proposed by September 1, a letter ballot will not be necessary. The nominees then are declared elected.

HOWARD C. PYLE
. . . old hand at association work.

Varied career . . . Pyle's nomination for the big engineering society post climaxes a colorful career. At various times he has been engineer, geologist, Army officer, banker, and oil-company executive.

Pyle was born in Williams, Ariz., but was educated in California colleges. He was graduated in 1926 from the University of California with the degree of B.S. in petroleum engineering and geology. He later obtained professional and master's degrees in petroleum engineering from the University of Southern California.

His first job was with Union Oil Co., which sent him to Venezuela as a geologist. After his tour in South America, Pyle returned to California where he received a series of rapid promotions to chief production engineer for Union.

World War II interrupted Pyle's civilian oil career, but he put his talents and experiences to work in the Army. He served as a captain on General Eisenhower's general staff in Europe. He helped coordinate oil imports for the Normandy invasion and the subsequent European campaigns. He returned home as a lieutenant colonel.

Pyle went into banking on his return to civilian life. He accepted a post of vice president for the Bank of America, in charge of the bank's oil-industry loans.

Steps up to management . . . Pyle left banking in 1947 and broadened his experience with management and consulting posts.

In 1947 he was named president of Continental Consolidated Corp. Three years later he opened his own office as a private consultant.

However, a year later he returned to the oil industry, assuming a post as director and president of Jergins Oil Co. In 1952 he became president, director, and chairman of the executive committee of Monterey Oil Co., his present job.

Pyle has contributed much of his time and energies to oil-industry association work. He was chairman of the A.I.M.E. Petroleum Branch in 1947 and has been a director of the institute since 1955. He also is a director of the American Petroleum Institute and the Western Oil and Gas Association.

He has written many technical papers published by the A.I.M.E. and other professional societies.

Other nominees . . . The Society of Petroleum Engineers also has nominated two other men for A.I.M.E. directors. They are:

. . . John P. Hammond of Tulsa, current president of the petroleum branch. He was nominated for a 3-year term. Hammond now is assistant general superintendent of production for Amerada Petroleum Corp.

. . . Basil P. Kantzer of Houston, who will be president of the petroleum engineers in 1958. He was also nominated for a 3-year term. Kantzer is vice president of Union Oil Co. in charge of the gulf division.

H. L. Hesselmeyer has been named manager of gas in the producing department of Standard Oil Co. of California, Western Operations, Inc. He succeeds **R. E. Clarke,** recently appointed manager of natural-gas utilization. In other appointments, **J. E. Mahle** was named drilling superintendent in the northern division, Taft, Calif. He succeeds **C. V. Reynolds,** who will retire August 1. **Carl Johnson,** drilling foreman, moved up to assistant drilling superintendent in the northern division succeeding Mahle.

W. H. (Curly) Robbins, superintendent with Moran Brothers, Inc., in Liberal, Kans., has retired. Robbins entered the oil business in 1915 when he joined Eastern Oil Co. as a roustabout. He has been with Moran since 1934.

Tom C. Gipson, tool pusher with Calvert Drilling, Inc., has been transferred to Cortez, Colo., from Dove Creek, Ohio.

William A. Walther, assistant district production superintendent for Sinclair Oil & Gas Co. in Silsbee, Tex., has been promoted to assistant division superintendent and transferred to Houston. Walther was with Southern Production Co. when it was purchased by Sinclair last year.

G. L. (Jerry) Knight, who recently retired as manager of foreign exploration for D. D. Feldman, Dallas, has opened geological consulting offices in Amarillo, Tex. Knight was division geologist for Phillips Petroleum Co. in Amarillo at one time.

R. C. Farley, assistant general superintendent of production for Ohio Oil Co.'s domestic operations, has been named operations manager of Oasis Oil Co. of Libya, Ohio subsidiary.

Alfred T. Krook has been elected a vice president of Bechtel Corp., Bechtel International Corp., and Canadian Bechtel, Ltd. Krook was formerly vice president and general manager of Engineering Management, Inc. He was also president and a director of Stone & Webster Canada, Ltd., and a vice president of Stone & Webster Engineering Corp., New York, at one time.

William E. Neptune has joined Pipe Line Technologists, Inc., Houston, as assistant to the president, and **Ralph C. Hughes, Jr., Richard D. Hull,** and **Richard S. Barfield** have joined the company's engineering staff. Neptune was formerly with Pan American Petroleum Corp. Hughes was with Sun Pipe Line Co., Hull with Sun Oil Co., and Barfield with Gulf Refining before joining Pipe Line Technologists.

Personals

Richard S. Stewart, vice president and assistant to the president of Standard Oil Co. (Ohio), has been named vice president for production. He will be responsible for all exploration and production operations of Sohio and its subsidiaries. He has been assistant to the president since 1949 and a vice president since 1954. He was president of Iricon Agency, Ltd., which represented the interests of nine American companies in the Iranian Oil Consortium, in 1955.

H. F. Wheaton has been named manager of the Winnipeg refinery of Imperial Oil, Ltd. He succeeds **W. A. Murray,** who recently resigned to become general manager and a director of Lago Oil & Transport Co., Ltd. Wheaton was formerly plant superintendent of Imperial's Regina refinery.

R. L. Steelman has been promoted by Texas Illinois Natural Gas Pipeline Co. from pipeline foreman in Woodsboro, Tex., to district engineer in Alice, Tex.

Connie L. Wilson has been named to succeed **J. B. Kennedy** as manager of Sinclair Oil & Gas Co.'s property-acquisition department. At the same time, department headquarters have been moved to Tulsa from Houston. Kennedy was recently elected executive vice president for operations. Wilson has been assistant manager of Sinclair's Fort Worth division for the past year.

B. H. Sherwood, chief mechanical engineer in the engineering division of Imperial Oil, Ltd., in Sarnia, Ont., has been appointed management assistant in the manufacturing department. Sherwood has been with Imperial since 1935.

Clarence E. Brehm, Mount Vernon, Ill., has been elected president of Independent Oil Producers and Land Owners Association, Tri-State, Inc. Other officers are **Victor R. Gallagher,** Evansville, Ind., first vice president; **Fletcher Farrar,** Mount Vernon, second vice president; **George Ellison,** Owensboro, Ky., third vice president; **John R. Lavens, Jr.,** Evansville, secretary; **Elmer L. Hoehn,** Evansville, executive secretary; and **Fred C. Newman,** Evansville, treasurer.

W. F. Walthall has been appointed manager of the new Calgary office of the oil operations branch of United States Smelting, Refining & Mining Co. Walthall has been at Billings, Mont.

Paul F. McBride has been named chief engineer for Pacific Northwest Pipeline Corp. McBride has been acting chief engineer for the company.

Roy Graves has been transferred by The California Co. from Billings, Mont., where he was division stratigrapher, to Denver as area geologist.

B. H. Wierick has been appointed district geologist in the new Denver office of American Petrofina Co. of Texas. Wierick was formerly with D & D Drilling Co. He has also been geologist with Owanah Oil & Development Co. and American Liberty Oil Co.

Irving Pollock has been appointed Houston regional manager of The Texas Co.'s technical services division. Pollock has been technologist in Chicago since 1955.

E. M. Wheeler has resigned as western district superintendent for British-American Oil Producing Co. to become an independent in Ventura, Calif. **J. R. Kinnie** has been appointed acting western district superintendent succeeding Wheeler.

Dr. William H. Schuette, general manager of Dow Chemical Co.'s Midland, Mich., division since 1955, has been elected a director of the company. He is also responsible for operations of Bay Refining Corp. and Bay Pipe Line Corp., Dow subsidiaries in Bay City, Mich., and for a new petrochemical plant now building at Bay City.

William M. Koehler, senior petroleum engineer with Humble Oil & Refining Co., has been transferred to Houston from Genoa, Tex.

Bruce A. Eckerson has been appointed process engineer in the gas department of Signal Oil & Gas Co. Eckerson was formerly engineer with California Research Corp.

Floyd Randolph has been appointed assistant district superintendent at Houma, La., for Sinclair Oil & Gas Co. He was formerly production foreman at Sweetwater, Tex.

Frank Podpechan, assistant to the division geologist, and **Steve Helbing,** assistant to the division landman, in Pan American Petroleum Corp.'s division office at Fort Worth, have resigned to open a land and geological consulting office in Albuquerque, N. M. **John J. Gill,** Albuquerque geologist, succeeds Podpechan for Pan Am in Fort Worth, and **Benjamin M. May,** Abilene landman, succeeds Helbing.

J. R. Morris, formerly on the staff of the manager of research at The Texas Co.'s Beacon, N. Y., research center, and **Warren G. Schlinger,** chemical engineer at Texaco's Montebello, Calif., laboratory, have been transferred to the company's Port Arthur, Tex., research laboratory. Morris will be assistant supervisor in chemical research. Schlinger has been named project engineer in fuels research.

R. E. Graham has been transferred by Pan American Petroleum Corp. from Fort Worth to Lubbock, Tex., as assistant district superintendent.

E. F. Hindman has been named superintendent of Texas Gas Transmission Corp.'s pipeline department. Hindman has been manager of the company's Louisiana division since 1955.

E. F. HINDMAN

W. O. DAVIS

He will move to Owensboro, Ky., from Lake Charles, La. **W. O. Davis,** assistant to the pipeline superintendent, will succeed Hindman as Louisiana division manager. **Edward Hamric,** assistant to the pipeline superintendent, has been promoted to assistant superintendent of the pipeline department.

Philip H. Halstead has joined American Overseas Petroleum, Ltd., as geologist in New York. He was formerly with The California Co. in New Orleans.

Raymond E. Ming, chief geologist for **David L. Gordon,** Houston independent, has opened consulting offices in Houston.

P. T. Reed, Jr., superintendent with Pecos Co. in Rankin, Tex., has joined Rycade Oil Corp. as superintendent in Wink, Tex.

Personals

Fred C. Koch, Wichita oil man, has been named a director of Northern Natural Gas Co. Koch is currently president and a director of Wood River Oil & Refining Co., Rock Island Oil & Refining Co., and Koch Oil Corp., all of Wichita. He is a director of Clover Oil Corp. and Vance Oil Corp.

Col. F. T. Davies, vice president of Gulf European Co., has been named head of a newly formed Gulf Oil Corp. coordinating group in London. The group will be concerned with Gulf's interests in the Eastern Hemisphere. Also appointed to the coordinating group are **Albert Gregerson,** vice president, production, Gulf Eastern Co.; **R. F. Temp,** crude-oil sales manager, Gulf Eastern Co.; **R. G. Martin,** transportation manager, Gulf Eastern; **L. Gombos,** counsel, Eastern Hemisphere; **S. V. Gasperina,** assistant comptroller, Gulf European Co.; **R. B. Hoffman,** marketing manager, Gulf Eastern; and **P. H. Boersig,** assistant treasurer, Gulf European.

Walter S. Hart, district geophysicist with Tidewater Oil Co., has been transferred to Oklahoma City from Tulsa.

Bob C. Jones has been transferred by Superior Oil Co. from Shawnee, Okla., to Oklahoma City as geophysicist.

Bennett L. Stokely, senior geologist with Sinclair Oil & Gas Co. in Silsbee, Tex., has been transferred to Corpus Christi, Tex. **Hugh F. Smith,** senior geologist in Houston, has been transferred to Silsbee to succeed Stokely.

Doyle G. Marrs, district petroleum engineer for Magnolia Petroleum Co. in Midland, Tex., has been promoted to senior reservoir engineer and transferred to Dallas.

Wilfred M. Stadtmiller, petroleum engineer with Monterey Oil Co., has been transferred from Bakersfield, Calif., to New Orleans.

Dr. Vladimir Haensel, director of refining research for Universal Oil Products Co., has been awarded an honorary degree of doctor of science by Northwestern University. Haensel was cited for his development of Platforming. He has been head of U.O.P.'s refining research since 1955.

Ralph James, Jr., has been named supervising engineer and **E. A. Clarke,** senior chemical engineer in the engineering division of Humble Oil & Refining Co.'s Baytown, Tex., refinery.

George W. Burgess, geologist with Kern County Land Co. in Bakersfield, Calif., has been promoted to Louisiana district supervisor in New Orleans.

James W. Harrison has left Lion Oil Co.'s Snyder, Tex., gasoline plant where he was plant engineer to join Dow Chemical Co. in Freeport, Tex., as research and development engineer.

Arnold F. Koenig has been transferred by Noble Drilling Co. from Edgerton, Wyo., to Hanna, Wyo., as tool pusher.

T. R. Diem has left Great Northern Oil Co. where he was maintenance supervisor in St. Paul, Minn., to join Pontiac Eastern Corp. in Purvis, Miss., as assistant maintenance superintendent.

Alan Rogers has been named chairman of the board of Weaver Oil, Ltd. He succeeds **L. G. Mickles,** who has resigned. **A. H. M. Carmichael** has been named vice president.

Edward H. Mayer has joined Monterey Oil Co. in Long Beach, Calif., as petroleum engineer. He was formerly engineer with Standard Oil Co. of California in Taft, Calif.

W. F. Hoot, an engineer with American Oil Co. at Texas City, Tex., has joined Atlas Processing Co. in Shreveport, La., as engineer.

D. W. Axford, geologist with Socony Mobil Oil Co. in New York, has been transferred to Mobil Oil of Canada, Ltd., as geologist in Calgary.

Herbert Hoover III, has been elected to junior membership in the Society of Petroleum Engineers of the A.I.M.E.

E. R. Muckelrath, Penrod Drilling Co. tool pusher, has been transferred to Ray, N. D., from Arcadia, La.

Glen M. Ruby, Salt Lake City consultant and formerly partner in the firm of Hoover, Curtice & Ruby, has retired. Ruby, an exploration geologist, has served as consultant to several foreign countries during his career. He entered the oil business in 1916.

Raymond E. Ard has been appointed district reservoir engineer for Gulf Oil Corp. and transferred to Amarillo, Tex., from Fort Worth.

J. D. Driskill, Jr., has left Grey Wolf Drilling Co. to join J. M. Flaitz & R. B. Mitchell as superintendent of production in Houston. Driskill was with Gulf Oil Corp. and D. D. Feldman Oil & Gas before joining Grey Wolf.

H. H. BIBLE

H. Harold Bible has been named vice president and assistant general manager of Lion Oil Co. division of Monsanto Chemical Co. Bible has been director of manufacturing for Lion since 1955.

J. B. Robertson, vice president in charge of manufacturing engineering. and development, will act as director of manufacturing for Lion.

W. S. Richardson has left W. C. McBride, Inc., in Tulsa to join Petroleum, Inc., in Oklahoma City as geologist.

W. P. Aycock has joined Humble Oil & Refining Co. as production engineer in Kingsville, Tex. Aycock was formerly research engineer with Texas Petroleum Research Committee in Austin.

DEATHS

Henry M. Day, 70, former vice president of the old Sinclair Exploration Co., died July 13 in New York.

Carden L. Green, 69, partner in the Tulsa drilling firm of Kirk-Green-Way, Inc., before its sale in 1951, died recently in San Francisco.

N. R. (Nick) Dodd, 64, Michigan and Kentucky independent wildcatter and producer, died recently in Greenville, Ky., after a heart attack.

Hugh Alan Bardeen, 70, president of Bardeen Oil Co., died July 14 in Los Angeles after a long illness.

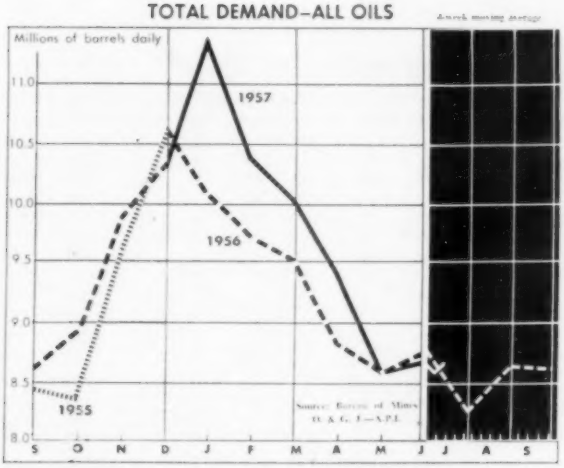
William C. Adams, 65, Tulsa consulting geologist, died recently in a Tulsa hospital after a heart attack. A graduate of Missouri School of Mines, Adams was chief geologist with the old Deep Rock Oil Corp. and geologist with Sinclair Oil Corp. before becoming a consultant in the 1930's.

Latest Figures . . . Industry Trends

A QUICK LOOK AT THE HIGHLIGHTS

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	6,833,300	DOWN	131,375	DOWN	244,423
Crude stocks	279,025,000	UP	1,274,000	UP	5,739,000
Completions	1,011	DOWN	36	DOWN	166
Refinery runs	7,972,000	UP	132,000	DOWN	56,000
Gasoline stocks	181,973,000	DOWN	3,947,000	UP	3,607,000
Kerosine stocks	29,253,000	UP	656,000	UP	1,838,000
Distillate stocks	125,564,000	UP	5,972,000	UP	21,043,000
Residual stocks	47,020,000	UP	772,000	UP	6,094,000
Four-product stocks	383,810,000	UP	3,453,000	UP	32,582,000
Total imports	1,641,500	UP	900	UP	168,600

TOTAL DEMAND—ALL OILS



Do Low Summer Distillate Prices Increase Total Summer Sales?

REFINERS are giving away part of their potential income from distillate fuels this summer. Considering increased cost of materials and labor, they may need all possible realization from every product to make money for the remainder of the year.

Formal summer discounts on distillate fuels are a part of normal marketing programs in some areas. These discounts do not represent a loss to the refiner. It is worth something to avoid the first rush of winter deliveries to jobbers or consumers. Also, liquids expand in summer so that the supplier selling on metered gallons doesn't have to deliver quite as much actual material per gallon in the summer as in the winter. The actual fuel in a gallon of distillate fuel may vary enough from summer to winter to represent a loss or gain of as much as 0.25 cent a gallon.

The refiner who grants an allowance of 0.5 cent a gallon on summer sales of home-heating oil may be allowing 0.25 cent for the convenience of delivering before the heating season starts. The other 0.25 he gets back because sales to jobbers and consumers normally are not corrected for temperatures.

This summer, prices are off more than can be accounted for on a basis of summer discounts. These cuts mean that some refiners have more distillate in their tanks than they want and are willing to sell for less to make room for more production.

The question is, "Do the lower prices actually increase summer sales?" Stocks are climbing rapidly, but stocks always go up in July. Also, demand for distillates reaches the low point in July. There is little to indicate that price reductions result in demand gains for the month. If lower prices do not generate additional sales for the industry as a whole, the lower prices represent losses.

The first table below shows summer demand for distillate fuels since 1952. Note that July has been the low month every year. It will be the low month this year even with price cuts.

The second table shows distillate stocks on the East Coast for the first three quarters of each year since 1954. Will price cuts hold down stocks this month? East Coast inventories went up 2,341,000 bbl. for week ended July 12.

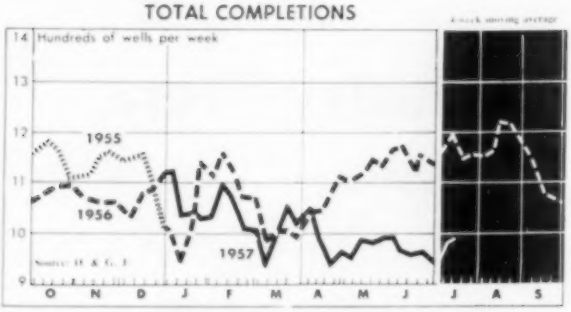
SUMMER TRENDS IN DISTILLATE DEMAND
(Thousands of barrels daily)

	June	July	August	Sept.
1952	861	746	838	956
1953	996	792	842	1,137
1954	908	868	942	1,086
1955	998	915	1,088	1,244
1956	1,116	1,015	1,066	1,370
Five-year average	976	867	955	1,159

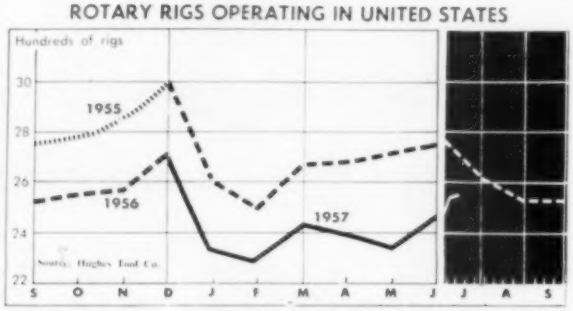
TRENDS IN EAST COAST DISTILLATE STOCKS
(Thousands of barrels)

	1954	1955	1956	1957
January 1	42,812	38,452	40,171	51,634
January 31	28,884	31,263	30,162	35,634
February 28	25,484	24,052	25,901	29,196
March 31	20,501	21,965	18,226	24,362
April 30	20,354	23,778	17,487	25,378
May 31	24,044	27,302	20,625	32,500
June 30	28,497	32,718	27,463	40,100
July 31	34,304	40,522	38,342	.....
August 31	40,616	47,209	49,139	.....
September 30	45,945	52,946	53,886	.....

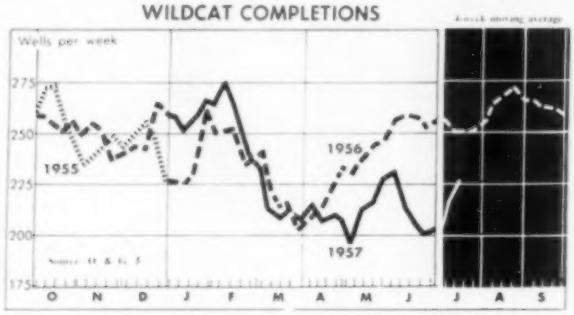
TOTAL COMPLETIONS



ROTARY RIGS OPERATING IN UNITED STATES



WILDCAT COMPLETIONS



ACTIVE ROTARY RIGS*

Area—	7-15-57	7-8-57	7-16-56
North Central and East	112	115	121
Southeast	39	46	30
Okla., Kans., Ark., Mo.	480	449	437
Louisiana	437	397	465
North and East Texas-Panhandle	378	419	398
Gulf and South Texas	202	201	257
West Texas-New Mexico	536	550	498
Rocky Mountain	262	257	280
Pacific Coast	102	107	129
Total United States	2,548	2,541	2,615
Canada	211	222	243

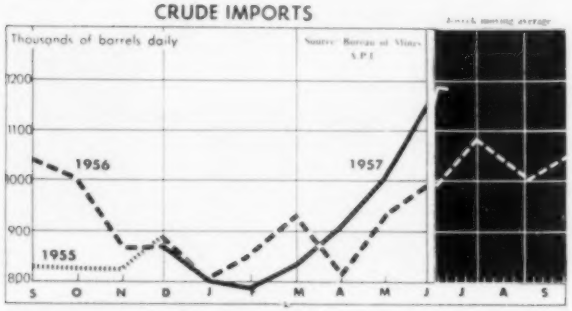
*Hughes Tool Co.

WEEKLY WELL COMPLETIONS . . . WEEK ENDED JULY 13, 1957

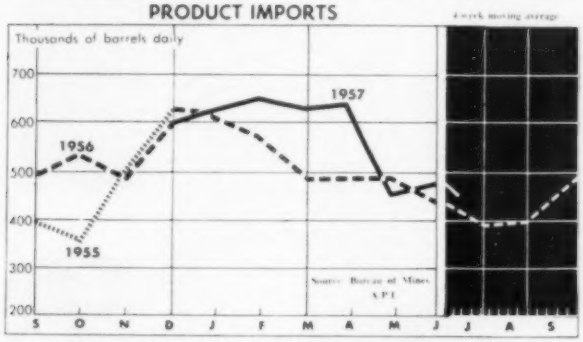
	Total wells							Cumulative		Total wildcats					Cumulative	
	Total	Crude	Cond.	Gas	Dry	Service	Footage	1957	1956	Total	Crude	Cond.	Gas	Dry	1957	1956
Alabama	3	1	0	0	2	0	14,255	52	‡60	2	0	0	0	2	14	‡28
Arkansas	17	11	0	1	5	0	43,635	546	421	2	0	0	0	2	99	95
California	56	37	0	1	18	0	241,130	1,128	1,174	18	1	0	1	16	279	253
Colorado	15	0	0	6	9	0	81,293	449	632	7	0	0	1	6	302	311
Illinois	52	18	0	0	34	0	132,995	1,287	1,972	15	0	0	0	15	320	370
Indiana	11	4	0	0	7	0	18,018	322	337	2	0	0	0	2	66	72
Kansas	110	38	0	15	48	9	391,048	2,214	2,734	24	2	0	1	21	440	583
Kentucky	29	14	0	0	15	0	43,448	727	904	8	0	0	0	8	146	210
Louisiana	81	38	1	12	30	0	535,541	2,010	2,072	10	0	0	1	9	362	402
North	41	18	0	3	20	0	145,341	687	854	7	0	0	0	7	91	126
South	21	7	0	7	7	0	221,597	933	976	1	0	0	0	1	223	233
Offshore	19	13	1	2	3	0	168,603	390	242	2	0	0	1	1	48	43
Michigan	8	4	0	0	4	0	22,673	208	244	3	0	0	0	3	86	85
Mississippi	12	2	1	1	8	0	88,794	201	236	6	0	0	1	5	102	104
Montana	9	7	0	0	2	0	57,622	196	194	2	0	0	0	2	67	62
Nebraska	20	9	0	1	10	0	118,270	432	564	8	1	0	0	7	242	274
New Mexico	31	13	0	13	5	0	140,280	1,097	1,011	6	1	0	1	4	147	126
Northwest	19	6	0	12	1	0	74,647	418	389	2	1	0	0	1	52	34
Southeast	12	7	0	1	4	0	65,633	679	632	4	0	0	1	3	95	92
New York	11	4	0	0	2	5	16,952	241		1	0	0	0	1	2	
North Dakota	1	1	0	0	0	0	9,280	142	132	0	0	0	0	0	56	37
Ohio	13	5	0	5	2	1	20,419	560	551	0	0	0	0	0	5	6
Oklahoma	122	52	0	11	51	8	417,675	3,280	4,661	14	1	0	4	9	375	497
Pennsylvania	0	0	0	0	0	0	0	353	†623	0	0	0	0	0	35	†15
Texas	362	172	6	4	172	8	1,459,505	11,460	11,845	103	2	1	0	100	2,885	3,048
Dist. 1	14	3	0	0	11	0	31,086	661	*1,735	6	0	0	0	6	224	*574
Dist. 2	17	4	1	1	11	0	92,966	381	*1,444	6	0	0	0	6	146	*467
Dist. 3	21	7	3	0	11	0	140,508	965		2	0	0	0	2	278	
Dist. 4	20	7	2	0	9	2	92,400	753		7	0	1	0	6	263	
East	17	6	0	0	11	0	68,606	660	598	7	0	0	0	7	204	230
Dist. 7-B	50	19	0	0	31	0	195,039	1,473		16	0	0	0	16	545	
West	95	69	0	1	21	4	479,285	3,266	3,106	15	0	0	0	15	486	517
Dist. 9	101	38	0	2	59	2	259,740	2,560	*4,268	37	2	0	0	35	682	*1,199
Dist. 10	27	19	0	0	8	0	99,875	741	694	7	0	0	0	7	57	61
Utah	3	0	0	1	2	0	11,848	102	70	2	0	0	1	1	58	41
West Virginia	19	1	0	16	2	0	53,854	330	350	1	0	0	0	1	15	13
Wyoming	16	7	0	0	9	0	74,834	428	418	4	1	0	0	3	141	115
Miscellaneous (Va.)	10	0	0	9	1	0	51,512	54	61	0	0	0	0	0	37	53
Total U. S.	**1,011**	438	8	96	438	31	4,044,881	27,819	31,266	**238**	9	1	11	217	6,281	6,800
Total prev. week	1,047	572	0	55	406	14	4,423,711			229	14	0	6	209		
Cumulative 1957	27,819	14,569	230	2,029	10,401	590	116,213,459			6,281	676	58	255	5,292		
Western Canada	63	41	0	2	20	0	291,883	1,576	1,451	21	4	0	1	16	434	

*Districts: 2 & 3, 1 & 4, 9 & 7-B, formerly combined. †Incl. New York. ‡Incl. Florida and Georgia.

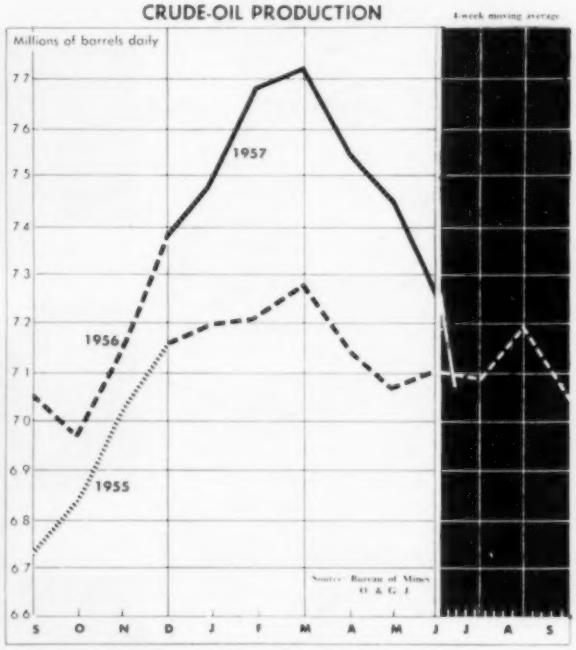
CRUDE IMPORTS



PRODUCT IMPORTS



CRUDE-OIL PRODUCTION

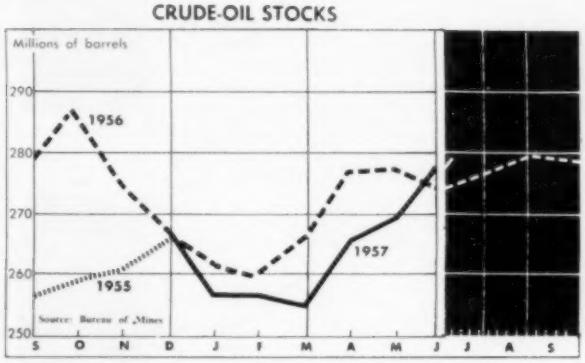


DAILY AVERAGE PRODUCTION FOR WEEK

	July 13, 1957			July 6
	Crude oil	Lease condensate	Total	total
Alabama	12,350	.....	12,350	12,550
Arkansas	83,350	300	83,650	85,300
California	925,200	....	925,200	924,600
Colorado	148,900	.....	148,900	148,900
Eastern	52,400	.....	52,400	51,800
Florida	1,350	.....	1,350	1,325
Illinois	161,300	.....	161,300	160,800
Indiana	28,200	.....	28,200	28,000
Kansas	†315,300	....	†315,300	†330,000
Kentucky	39,600	.....	39,600	39,600
Louisiana	801,750	75,000	876,750	879,900
North	129,750	3,000	132,750	135,050
South	672,000	72,000	744,000	744,850
Michigan	26,000	.....	26,000	25,700
Mississippi	110,150	4,200	114,350	114,475
Montana	72,700	.....	72,700	74,350
Nebraska	50,350	.....	50,350	51,650
Nevada	100	.....	100	100
New Mexico	252,500	4,400	256,900	258,325
North Dakota	34,900	.....	34,900	40,700
Oklahoma	†544,400	.....	†544,400	†551,200
Texas	2,741,000	53,700	2,794,700	2,883,400
Dist. 1	52,000	450	52,450	52,875
Dist. 2	126,000	8,450	134,450	139,600
Dist. 3	400,000	26,500	426,500	436,500
Dist. 4	210,000	6,100	216,100	221,525
Dist. 5	36,000	300	36,300	37,450
Dist. 6	122,000	6,300	128,300	132,000
East Texas field	173,000	...	173,000	180,700
Dist. 7-B	151,000	50	151,050	155,625
Dist. 7-C	140,000	3,650	143,650	150,225
Dist. 8	1,025,000	1,100	1,026,100	1,067,525
Dist. 9	201,000	500	201,500	204,925
Dist. 10	105,000	300	105,300	104,450
Utah	10,000	.....	10,000	8,000
Wyoming	283,800	.....	283,800	293,900
Others	‡100	.....	‡100	‡100
Total U. S.	6,695,700	137,600	**6,833,300**	6,964,675
Change from previous week, down			**131,375**	
Canada	†464,750	.....	†464,750	†520,500
Total U. S. production, January 1-July 13			1,451,403,800 bbl.	
Same period last year (crude plus cond.)			*1,396,189,150 bbl.	

*Includes 24,484,350 bbl. condensate. †Week ended previous Monday. ‡South Dakota.

CRUDE-OIL STOCKS



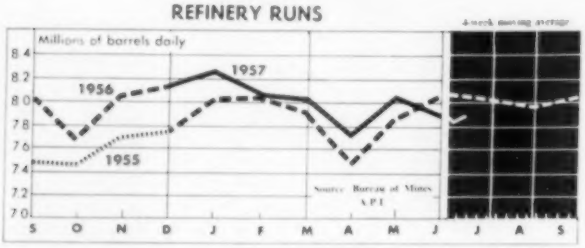
CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

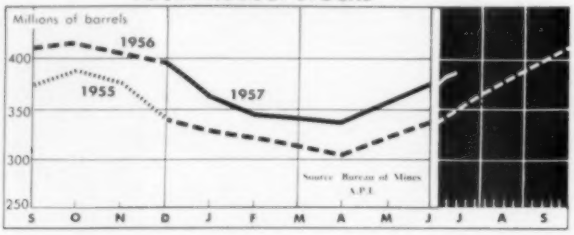
	7-6-57	6-29-57	7-7-56
Pennsylvania Grade	2,851	2,812	2,609
Other Appalachian	1,501	1,749	2,389
Illinois, Indiana, Michigan	10,652	9,858	11,481
Nebraska, North Dakota	2,627	2,568	2,405
Kansas	10,743	10,896	8,833
Oklahoma	21,530	21,700	26,145
Arkansas	2,536	2,748	2,977
Louisiana	18,831	18,249	15,188
North	2,893	2,727	2,480
South	15,938	15,522	12,708
Mississippi, Alabama, and Florida	3,447	3,110	3,015
New Mexico	8,632	7,615	7,342
Texas	128,472	128,858	121,153
East Texas proper	11,450	11,613	8,495
West Texas	60,800	60,555	59,443
Texas Gulf	24,646	24,579	21,343
Other Texas	31,576	32,111	31,872
Wyoming	17,446	17,868	19,480
Other Rocky Mountain	5,923	6,030	7,014
California	28,084	27,702	28,317
Foreign	†15,750	15,520	14,938
Total	279,025	277,283	273,286

*Bureau of Mines. †Includes 3,303,000 bbl. in California.

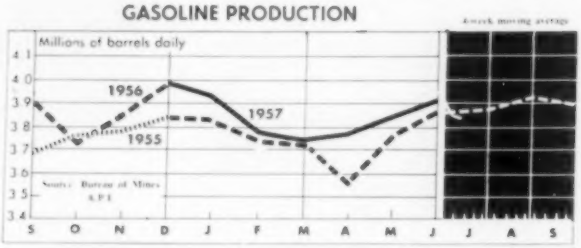
REFINERY RUNS



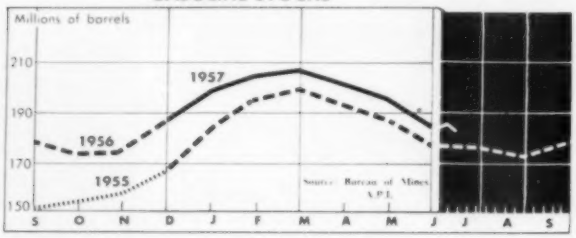
FOUR-PRODUCT STOCKS



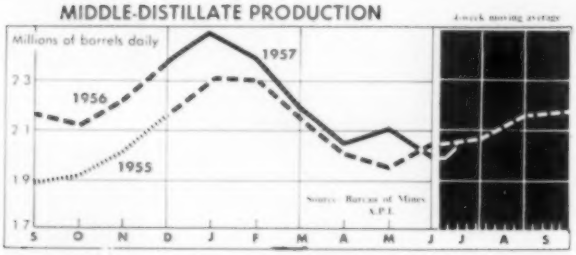
GASOLINE PRODUCTION



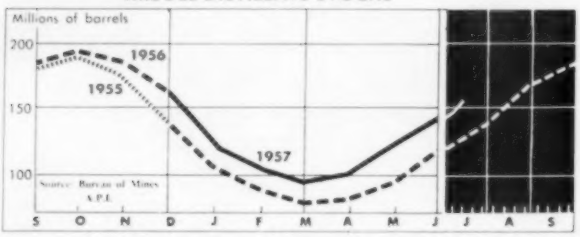
GASOLINE STOCKS



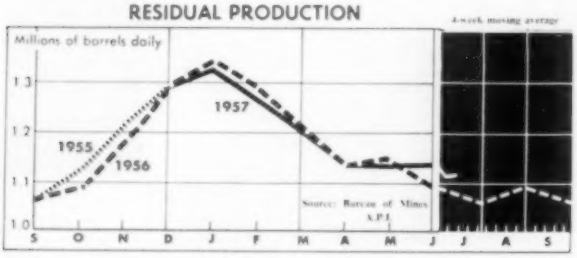
MIDDLE-DISTILLATE PRODUCTION



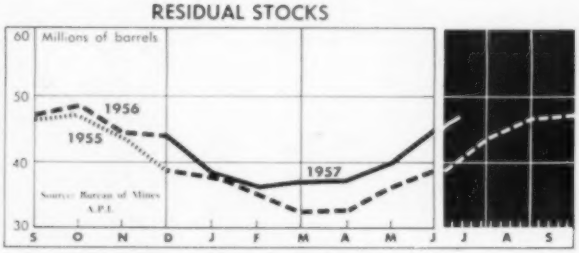
MIDDLE-DISTILLATE STOCKS



RESIDUAL PRODUCTION



RESIDUAL STOCKS



A.P.I. REFINERY REPORT, JULY 12, 1957

(Thousands of barrels)

District—	Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.	Stocks‡—Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, July 1956—Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.
East Coast	1,275	503.0	22.9	331.4	256.9	41,882	11,369	43,608	12,166	1,164	472.5	26.2	313.4	196.9
Appalachian:														
District 1	105	50.3	3.1	24.1	3.1	4,697	533	2,417	489	107	42.2	4.4	24.2	5.5
District 2	50	29.6	2.1	7.3	7.3	2,336	533	817	247	100	53.3	4.6	14.3	11.9
Ind., Ill., Ky.	1,280	690.4	65.2	252.0	157.7	32,626	5,610	18,587	6,161	1,375	718.2	79.7	261.4	144.5
Minn., Wis., Dak.	104	48.6	3.9	38.3	9.3	5,721	1,153	5,878	398	92	46.7	7.2	24.3	4.0
Okla., Kans., Mo.	747	400.6	9.6	174.0	32.1	15,401	1,512	11,567	1,028	724	390.6	18.7	162.9	27.3
Inland Texas	287	190.6	7.9	57.1	25.3	7,114	408	2,403	1,832	273	193.9	10.1	42.8	24.3
Texas Gulf Coast	1,900	914.6	73.9	486.6	239.6	23,964	3,303	14,724	6,112	1,914	926.5	91.5	479.9	251.1
La. Gulf Coast	701	385.4	45.4	201.3	45.0	10,637	3,474	6,712	1,646	713	359.7	39.7	181.9	40.9
N. La. and Ark.	86	33.7	4.9	20.1	3.9	4,084	693	1,963	132	103	37.9	6.8	22.9	6.2
Rocky Mountain:														
New Mexico	26	13.0	0.7	5.1	2.7	392	12	90	67	25	13.0	0.3	4.7	3.6
Other Rocky Mtn.	281	136.1	4.7	63.2	35.9	6,972	268	3,086	1,107	281	131.7	2.5	67.1	27.9
California	1,130	441.4	6.0	196.6	286.8	26,147	385	13,712	15,635	1,143	491.3	4.1	167.1	321.6
July 12, 1957	7,972	3,837.3	250.3	1,857.1	1,105.6	181,973	29,253	125,564	47,020	8,014	3,877.5	295.8	1,766.9	1,065.7
July 5, 1957	7,840	3,696.6	249.0	1,778.0	1,104.3	185,920	28,597	119,592	46,248					
July 13, 1956	8,028	3,885.1	323.6	1,800.9	1,127.6	178,366	27,415	104,521	40,926					

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

Crude-Oil and Refinery Prices at Representative U. S. and Foreign Points

REFINED-PRODUCT PRICES

Following quotations are for refinery products in cents per gallon moving in interstate shipments on Wednesday each week unless otherwise noted. Crude-oil prices are per barrel at the wells unless otherwise listed.

GASOLINE*

Mid-Continent (Group 3):	
Regular (89 octane)	11.25-11.75
Premium (98 octane)	14.00-14.50
Gulf Coast (cargoes for coastwise or export movements):	
Regular (90 octane)	11.00-11.50
Regular (92 octane)	11.25-11.75
Premium (97 octane)	13.00-13.50
Premium (98 octane)	13.25-13.75
California (rack):	
Regular (88 octane)	13.1
Premium (96 octane)	15.1
Premium (98 octane)	15.8
Caribbean area (cargoes):	
Regular (87 octane)	10.875
Premium (93 octane)	11.75

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

NATURAL GASOLINE*

Group 3:	
Grade 26-70	4.0
Breckenridge:	
Grade 26-70	3.5

*If 26-70 natural is considered as 100 per cent, prices for lower-vapor-pressure grades increase 2.5 per cent for each unit drop in Reid vapor pressure down to and including 16 lb. Prices for grades below 16 lb. may vary slightly by areas or plants.

KEROSINE AND DISTILLATE

Mid-Continent (Group 3):	
Kerosine 42-44	9.75-10.25
Diesel oil (58 d.i. and above)	9.375-9.75
Distillate No. 1	9.375-9.75
Distillate No. 2	8.75-9.125
Gulf Coast (cargoes):	
Kerosine 41-43	9.125-9.75
Distillate No. 2	9.00-9.50
New York Harbor (barges):	
Kerosine 41-43	11.15
Distillate No. 2	10.65
Diesel fuel, 48-52 d.i.	10.95
Caribbean area (cargoes):	
★ Distillate No. 2	9.25

WAX (LB.)

Oklahoma (Group 3):	
132-135 A.m.p. (semi-refined) in tank cars	6.50
New York (export):	
126-130 A.m.p. crude scale (solid in bags or barrels)	7.35

★Denotes change from previous week.

RESIDUAL FUEL (BBL.)

Mid-Continent (Group 3):	
Residual fuel (max. 1% S)	$1.85-2.10
Gulf Coast (cargoes):	
Bunker C fuel	$2.65-3.00
New York Harbor (barges):	
★ Bunker C fuel	$3.05
Caribbean (cargoes):	
Bunker C	$2.55
California (rack):	
Bunker C fuel, Los Angeles	$2.85-3.00

LUBRICATING OILS

Mid-Continent (Group 3):	
150-160 bright stock, solvent refined, 0-10 p.p., v.i.	25.5
200 vis. neutral oil, solvent refined, 0-10 p.p., 95 v.i.	22.25
Pennsylvania Grade:	
145-155 vis. at 210, bright stock, 8 color, 25 p.t.	28
200 vis. neutral (180 at 100°), 25 p.t.	26

CRUDE-OIL PRICES

GRAVITY SCHEDULE

	Signal Hill, Calif.	Mid-Cont.*	Gulf Coast Tex.†	West Tex.‡ N.M.	Wyo. (sour)
14-14.9	$2.67				
15-15.9	2.71				$1.89
16-16.9	2.74				1.94
17-17.9	2.78				1.99
18-18.9	2.82				2.04
19-19.9	2.85				2.09
20-20.9	2.89	$2.75		$2.62	2.14
21-21.9	2.93	2.77		2.64	2.19
22-22.9	2.97	2.79		2.66	2.24
23-33.9	3.01	2.81	$3.44	2.68	2.29
24-24.9	3.05	2.83	3.46	2.70	2.34
25-25.9	3.09	2.85	3.48	2.72	2.39
26-26.9	3.13	2.87	3.50	2.74	2.44
27-27.9	3.17	2.89	3.52	2.76	2.49
28-28.9	3.22	2.91	3.54	2.78	2.54
29-29.9	3.27	2.93	3.56	2.80	2.59
30-30.9	3.32	2.95	....	2.82	2.63
31-31.9	3.38	2.97	....	2.84	2.67
32-32.9	3.44	2.99	....	2.86	2.71
33-33.9	3.50	3.01	....	2.88	2.75
34-34.9	3.56	3.03	....	2.90	2.79
35-35.9	3.61	3.05	....	2.92	2.83
36-36.9	3.65	3.07	....	2.94	2.87
37-37.9	3.68	3.09	....	2.96	2.89
38-38.9	....	3.11	....	2.98	2.91
39-39.9	....	3.13	....	3.00	2.93
40 and up	....	3.15	....	3.02	2.95

*Includes Oklahoma, part of Kansas, North Dakota, West Texas (sweet) and North Central Texas. †Low Cold test Gulf Coast. ‡Sour.

Effective dates: California January 17, 1957, east of California, January 3-January 10, 1957; Pennsylvania Grade, January 16, 1957.

Some crudes in North Central Texas and West Central Texas, are on the intermediate schedules.

FLAT PRICES

Louisiana:	
Bienville (distillate)	$3.05
Ville Platte	3.45
Texas:	
East Texas	3.25
Conroe	3.53
Van	3.08
Pennsylvania Grade:	
Bradford	4.88
Middle District	4.70
Southwest Pennsylvania	4.41
West Virginia	4.23
Buckeye Grade	4.23
Zanesville Grade	3.27
Illinois Basin	3.15
Canada:	
Leduc-Woodbend	2.78
Redwater (Alta.)	2.67
Smiley (Sask.)	2.44
Pembina	2.65

FOREIGN

Venezuela:	
Cumarebo, 48°-49.9°, Tucupido	3.75
San Joaquin, 41°-41.9°, Puerto La Cruz	3.34
Oficina, 35°-35.9°, Puerto La Cruz	3.05
Tia Juana medium, 26.5°-26.9°, Amuay*	2.55
Quiriquire, 16.5°-16.9°, Caripito	2.45
Lagunillas heavy, flat, Amuay or Las Piedras*	2.38
Bachaquero, flat, Las Piedras*	2.23

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

Middle East, Persian Gulf (cargoes, f.o.b. lifting port):	
Arabian, 36.0°-36.9°, Ras Tanura	$2.12
Iranian, 34.0°-34.9°, Bandar Masur	2.04
Iranian, 34.0°-34.9°, Abadan	1.99
Iraq, 36.0°-36.9°, Fao	2.00
Kuwait, 31.0°-31.9°, Mina-al-Ahmadi	1.85
Qatar, 39.0°-39.9°, Umm Said	2.19
Middle East, E. Mediterranean:	
Arabian, 36.0°-36.9°, Sidon	2.69
Iraq, 36.0°-36.9°, Tripoli, Banias	2.69
Far East (cargoes, f.o.b. Lutong, Sarawak):	
Seria Light, 37°	2.75

TANKER RATES PER LONG TON

(Latest reported spot fixtures)

★ Gulf-U.S.N.H., clean (USMC—15%)	$2.42
★ Gulf-U.S.N.H., dirty (USMC—27.5%)	2.07
★ Carib.-U.S.N.H., dirty (USMC—45%)	1.49
★ Carib.-U.K., dirty (Scale—27.5%) (23s. 7d.)	3.27
★ P.G.-U.K., dirty (Scale—30%) (33s. 6d.)	4.68

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FOR SALE OR RENT: One GBLU 4" x 11" Oil Well packaged gas compressor. One "HB" 5¼" x 13" HOMCO packaged gas compressor. Alfred B. Kern, 305 Kennedy Building, Tulsa, Okla.

FOR SALE—125 B/D Polymer Unit, California Research Corporation, stainless steel, practically new, used a few months. Skid mounted for easy removal. Believe suitable for Propylene condensation reaction. Will sell for less than one-half of new cost. Telephone: RIverside 1-4645, Dallas, Texas. Box K-267, The Oil and Gas Journal, Tulsa, Oklahoma.

TWO 6MO-970 BUDA ENGINES, complete with clutch, power takeoff and 12 volt starting system. Excellent condition. Only 1½ years old. Surplus due to electrification. The Carter Oil Company, Carmi, Illinois. Mr. M. L. Kinnan.

FOR SALE—2500 B/D refinery located in oil field and natural gasoline area. Completely overhauled in good operating condition with refinery superintendent available. Located in good gasoline market—can make 2,000,000 gallons per month of jet fuel in a very profitable operation. Equipment—2500 Barrel per day crude still; 1200 B/D Thermal Cracker; 90,000 barrels of tanks; largest tank nearly 40,000 barrels new; water well; Ethyl lead house; jet fuel loading rack; approximately 10 acres located on main Highway; property over gas. Good labor available. Priced right. Telephone: RIverside 1-4645, Dallas, Texas. Box K-268, The Oil and Gas Journal, Tulsa, Oklahoma.

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- 800 hp Worthington in operation. Too large for present job. Owner will sacrifice.
- 100 hp Worthington "packaged unit" with 145 GKU Waukesha, skid mtd. drives & coolers, large cylinder selection. 11" stroke.
- Two ea. 7 x 3½ x 7 tandem CP with jacket water & gas coolers—skid mounted with engines. Approx 35 hp.
- 10 x 10 Ingersoll, skid mounted—50 hp.
- 50 hp, 6½ x 5½, 2 cyl. vert. Gardner-Denver. New. Model AAE-1003.
- New Carson "packaged units," Worthington compressor, Le Roi engine to fit your requirements.
- 120 hp packaged IR-Le Roi H-844 (new) intercooler & after cooler—new warranty.
- 160 CFM Worthington Air Compressor powered by Hercules engine.

Carson Machine & Supply Co.

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TULSA, GREAT BEND, GARDEN CITY, KANS.

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71 SPEED STAR Drilling Rig (40 ft. Mast) with tools for drilling 4 inch to 10 inch wells. A-1 condition. Located at Bradner, Ohio in Wood County. Mrs. Helen R. Stahl, 113 East St., Bradner, Ohio. Phone WAyne 2952.

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1—2' x 50' tower, 24 trays.
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8—Welded storage tanks, 5,000, 2,000 bbl.
8—Hi-vol pumps, 10 x 7 x 18, 10 x 6 x 12, 6 x 4 x 12, 6 x 3 x 8.

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2—12' x 45' Storage Tanks, 25#
1—14' x 21' Clay Tower, 125#
1—8' x 75' Tower, 20 Trays, 25#
1—18" x 32' Tower, 15 Trays, 160#
2—8½' x 25' Tanks, 50#
5—Packed Towers 14" x 40', 18" x 23', 168# Wyatt 1950.
1—Poly Reactor, 550#, 24" x 28'.

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3 Pacific ITB, 400 gpm.—2,000' hd. 735 gpm—3,100' hd.
5 Pacific SVTB, 612 gpm—600' hd. 324 gpm—480' hd, 308 gpm—516' hd, 193 gpm—389' hd.
1 Pacific HVTB (unused) 1270 GPM—408' Hd.
8J hot oil pump 3 x 9, 13 st, 325 gpm, 4600' hd.

HEAT EXCHANGERS

4—Kellogg Adm. Flg. Hd. 2200, 1300 Sq. Ft., 315#
4—Kellogg Steel Flg. Hed. 800, 650, 500 Sq. Ft.
18—GR Fin Tubes, 73 Sq. Ft.
6—Brown fintube exchangers, 300# 140 Sq. Ft. 4-6 chrome
5—Steel 1,000, 900, 800, 600, 300 Sq. Ft.
6—Adm. 785, 742, 425 Sq. Ft.
30—304 SS shell & tube condensers 100-1000 Sq. Ft.

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1 Worth LTC-6 800 hp.
3 Penn Comps 100 CFM 500 lbs.
385 CFM 160 lbs.

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Lab Petro-Chem furnace 50,000 BTU/hr.
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2—5,000′ RIGS 1—2,500′ Rig

Located in Oklahoma

1—U-34 Powered by Twin GK 145 Torque Converter Drive—Gardner-Denver Pump FXK with two Compounded Buda MD970 Lee C. Moore 96′ Mast—4,500′ 4½—16.6# DP and misc. equipment to complete rig.

1—U34 with WAK Torque Converter drive—Gardner-Denver FXK with NKU—127′ Lee C. Moore Mast with 8′ substructure. 4,500′ 4½—16.6# Drill pipe and misc. equipment to complete rig.

1—Wichita Drawworks powered by 145 GKU, 7¼x10 FXO pump with WAK—Wichita 65′ Trailer Mounted Structural Mast (Stands back singles), 2,500′ 4½—16.6# drill pipe and misc. equipment to complete rig.

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1209 ATLAS LIFE BUILDING
TULSA, OKLAHOMA
Phone: CHerry 2-7168

PRESSURE VESSELS

Two—6'3" Diameter x 93'1" long
Shell 1¼"—Heads 1½"
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250 psi W.P.—Excellent condition
Suitable for Process or LPG Storage
Detailed Drawings Available
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- CONDENSERS—HEAT EXCHANGERS
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RIG WANTED. Top rated drilling and producing company would pay top price for late model 4000 to 6000 ft. drilling rig, on percentage of contract work performed. Would pay cash for associated drilling string and give due-date note on rig. Would consider rigs within 500 miles of Midland, Texas. Box 368, Midland, Texas.

WANTED

Fractionating Tower, 3′ Diameter, 25/30 Trays, 20" Min. Spacing, Atmospheric Pressure.

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Karns City, Pa.
Phone: George Beck—PEtrolia 2430

WANTED

WANTED—Oilfield sales and service organization to act as manufacturers representative for production equipment. Distributorships now available for California and Oklahoma. Box K-243, The Oil and Gas Journal, Tulsa, Oklahoma.

HELP WANTED

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GEOPHYSICISTS
(South America)

Immediate openings with major oil company for graduate engineers with experience in drilling, production, reservoir and equipment; also geophysicists experienced in interpretation and supervision. Working knowledge of Spanish desirable but not essential.

Liberal Employe Benefit Plans. Salary commensurate with experience.

Forward personal data and college transcript to: Box K-249, The Oil and Gas Journal, Tulsa, Oklahoma.

HELP WANTED

SALES REPRESENTATIVE for oilfield supply firm to call on district offices. Must have oilfield supply and tubular products experience. Probably presently employed. Western Kansas area. Salary open. Write P. O. Box 2205, Tulsa, Okla.

WANTED, PETROLEUM ENGINEER: Expanding independent oil company has opening for petroleum engineer with two to four years experience. Write Drilling and Production Department, P. O. Box 749, Denver, Colorado.

EXPLORATION GEOLOGIST

Long established independent West Texas Oil Company desires to engage capable exploration geologist to develop new drilling and development prospects. Must be thoroughly experienced and acquainted in West Texas-New Mexico Area. Sound initiative essential. For interview briefly state background and qualifications. Replies confidential to

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Experience in crude oil, natural gas buying or in geological exploration. Knowledge of marketing of oil field products or in application and use of oil or gas in a refinery, natural gasoline plant, condensate plant, pipeline company, engineering office . . . valuable.

- Exceptional opportunity for advancement to management
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(To Age 35)

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ROHM & HAAS COMPANY
Special Products Department
Washington Square, Philadelphia 5, Pa.

Send complete resume of training and experience. All replies will be acknowledged and treated in confidence.

HELP WANTED

FOREIGN EMPLOYMENT. List oil companies, drilling contractors, seismograph contractors, showing where apply foreign jobs, $5.00 cash. OIML Co., Box 2603, Tulsa, Okla.

REFINERY ENGINEER for independent company located in Kansas. Project estimating, design and drafting experience. Give detailed resume of education, experience and salary expected. Box K-226, The Oil and Gas Journal, Tulsa, Oklahoma.

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Immediate opening for experienced graduate engineer for employment in Louisiana Gulf Coast Area. Office and Supervisory duties on Drilling wells, Well Completions and Workovers. Send resume to:

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All information confidential.
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FIELD SALESMAN for oilfield supply store. Must have general oilfield supply and tubular products experience. The man we want is probably presently employed. Oklahoma or Kansas area. Salary open. Write Box 2205, Tulsa, Oklahoma.

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In charge of all production and drilling operations, reporting directly to Vice President. Must know oil field operations and administrative work. Graduate Engineer or Geologist. Age to 55.

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Company expansion has created a laboratory supervisory position for a Chemist or Chemical Engineer with 5 - 10 years varied refinery laboratory experience.

New position also open for chemist or chemical engineer with 3 - 7 years refinery laboratory experience.

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Post Office Box 1581
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An opening exists for an experienced equipment engineer to be assigned to our Division Petroleum Engineering Staff located in Houston, Texas. Applicant must be highly competent in the application of all phases of production equipment.

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Attention: A. A. WILLIAMS,
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HELP WANTED

GEOLOGIST WANTED by established independent producing company. Must have two or more years of experience in Oklahoma subsurface work. Position affords permanent employment in Tulsa, Oklahoma. Applications will be confidential. Box K-273, The Oil and Gas Journal, Tulsa, Oklahoma.

AGGRESSIVE INDEPENDENT oil company located in Calgary, Alberta, has opening for graduate petroleum engineer with three to eight years experience in appraisal and production engineering. Must have initiative and be responsible person. Salary range $750.00 to $900.00 a month depending on experience. Furnish details of education and experience in letter. All replies considered confidential. V. B. Harris, 3300 Republic National Bank Building, Dallas, Texas.

SALES MANAGER capable of supervising and directing outside sales for established company manufacturing oil field specialties. Must travel. Advise age and experience. Excellent opportunity for aggressive man. All replies treated confidential. Box K-280, The Oil and Gas Journal, Tulsa, Oklahoma.

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For Caracas, Venezuela

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GEOLOGIST: Eleven years experience as Chief Geologist, and Manager of Exploration for Independent and Major, in United States, Latin America. Qualified to manage all phases, Petroleum Exploration, Development, Evaluation. Desires responsible position in the United States or Foreign Country. Box K-272, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGICAL ENGINEER: Age 32. Presently DIRECTOR OF EXPLORATION for leading Independent. Can capably manage an Exploration and Developmental Program. Desire a salary-interest arrangement for family security. Box K-271, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST-ENGINEER. Desires responsible position with substantial independent oil company or drilling contractor. Six years diversified experience including subsurface mapping and interpretation, field development, well site setting, and completions. Capable of evaluating and screening drilling prospects. Presently employed. Resume on request. Box K-278, The Oil and Gas Journal, Tulsa, Oklahoma.

ENGINEER. GRADUATE. Nine years major company experience, five as supervisor, in reservoir, drilling, workover, production. Desire responsible position commensurate with experience, preferably Rocky Mountain or West Coast. Box K-276, The Oil and Gas Journal, Tulsa, Oklahoma.

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OIL LEASES IN BOOMING

4-Corners Area. November Indian Lease sale brought 30 Million Dollars. Some leases sold for $3,200 per acre. Wells estimated up to 1500 barrels of oil per day. Oil Leases from $2.25 an acre. Fortunes being made. Write for free information now. **ATLAS OIL SURVEY, Dept. OJ-7, Colorado Bldg., Denver 2, Colo.**

LEASES

160 ACRE LEASE. 4 new wells near, up to 50 bbls. an hour. Pipe line. 3 pays, Hominy. Bergen and Arbuckle. Above 2000 feet. 4 years to run. Perfect title. Outright sale cash. L. Price, Coweta, Okla.

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BOTTOM HOLE Heater Manufacturer has distributorships available to oil fields, sales and service organizations throughout America. Electronic Oil Well Heater Company, 4109 West Jefferson Blvd., Los Angeles 16, California.

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BUSINESS OPPORTUNITIES

FUNDS AVAILABLE to drill 100 wells on proven acreage only. Detailed offers invited. Box 613, Fort Worth, Texas.

DRILLING CONTRACTORS able to make drilling contract in France wanted. Write to S.I.R.E.P. 19, Cours Pierre Puget, Marseille, France for information.

HEALTH FORCES sacrifice sale of this exceptional 11 year old $100,000 volume business! The company's permit allows owner to haul any material or equipment pertaining to oil or gas business. Centrally located in heart of gas and oil field area and fine farming, it is near state university and industries and oil refineries. Unlimited potential for go-getter. Dimit Trucking Co., Mount Pleasant, Mich.

WANT BROKER to set up company to fully develop 10 producing leases, thirty wells now on properties. H. A. Miller, Glasgow, Ky.

FINANCIAL CONTACTS. Underwriters, Brokers, Private Finders of Capital reached. No shopping. Confidential. FREE ENTERPRISE ASSOCIATES, 817 51st St., Brooklyn, N. Y.

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320 ACRE LEASE in Osage County, Oklahoma. 40 barrel settled primary production. Approximately half of lease not developed. Several proven drilling locations. Pipeline connection. Production from Bartlesville sand. Well depths 1500 to 1700 feet. Box K-275, The Oil and Gas Journal, Tulsa, Oklahoma.

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PRODUCING oil, gas properties, also royalties wanted. Any size, any amount. Complete details in first letter. Box 231, Scarsdale, N. Y.

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KRAFTBILT FORMS, designed especially for the oil industry, are popular because they are efficient, economical. For plat sheets, well log strips, columnar pads, all production reporting forms, material transfers, truck reports, all administrative forms, ask for new catalog 1154-K. Ross-Martin Co., P. O. Box 800-A, Tulsa 1, Okla.

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Successful Wildcats

CALIFORNIA

Madera County: Calitex Land & Development Co. 2-6 Southern Realty, SW SE 6-10s-14e, 4,000 M.c.f. daily, 19/64-in. choke perfs. 7,995-8,010 ft., TD 8,032. (Extension of Chowchilla gas field ½-mile north of production.)

Orange County: Bert Aston 7-A Lomita, NW NW 20-5s-11w, 300 BOPD net, 8 per cent cut, 30°-gravity, 18/64-in. choke, perfs. 8,110-50 ft., TD 9,000 ft. (New fault block discovery on northwest flank of Sunset Beach field.)

LOUISIANA OFFSHORE

Plaquemines Parish: Continental Oil Co. (C.A. T.C Group) 2 OCS-0149 (State Lease 986), Block 81, West Delta area, Gulf of Mexico. IP 284 M.c.f. daily, ⅛-in., dry gas, TP 925 psi., perforations 2,738-50 ft. TD 13,883 ft. (New field.)

TEXAS GULF COAST

Jasper County: Atlantic Refining Co. 1 Henderson, J. L. Gebhart Sur., A-831 (1½ miles northeast of Kirbyville field). IP 154.80 BOPD, 9/64-in., 41.1°, TP 750 psi., GOR 655 cu. ft. per bbl., perforations 6,276-82½ ft. (Yegua 3-D sand). TD 9,200 ft. (New field—Gebhart.)

Jefferson County: Meredith & Co. et al 1 Boyt et al, Sarah Miles Sur., A-173 (4 miles north of Fannett). IP 148.71 BOPD, ⅛-in., 41.2°, TP 1,100 psi., GOR 791 cu. ft. per bbl., perforations 7,975-79 ft. TD 8,353 ft. (New field—2 miles south of South China field.)

Newton County: Texas Gulf Producing Co. and Rowan Oil Co. 5 Morgan et al, George Hayden Sur., A-919 (3 miles west of Hartburg). IP 120.95 BOPD, ⅛-in., 41.2°, TP 1,500 psi., GOR 710 cu. ft. per bbl., perforations 7,552-62 ft. (Frio-Struma sand). TD 7,769 ft. (New pay in North Hartburg field.)

Wharton County: Sam G. Harrison 1 Shult, T. W. Heard 30 Sur., A-510. Shut-in gas well, no gage, perforations 6,100 ft. (approximate). TD 7,312 ft. (New pay and extension in Louise field.)

SOUTH TEXAS

Webb County: Jake L. Hamon and Sunray Mid-Continent Oil Co. 1 Hurt, Sec. 1110, Blk. 11, GWT&P Sur., A-2526 (2 miles NW of Mirando City). IPP 45.30 BOPD (net), 55 per cent water, 36.9°, perfs. 1,493-99 ft. (Mirando sand). TD 1,504 ft. (New field—West Mirando City.)

WYOMING

Big Horn County: Colorado Oil & Gas Co. 1 Government, C NW NW 9-55n-96w. IP swabbed 7 BOPH for 15 hours. Phosphoria discovery, new field. TD 6,798 ft. Madison.

Big Horn County: Western Giant Oil 10X Government, NE NW SW 4-54n-94w. IPP 60 BOPD, Amsden new pay discovery. TD 602 ft. Madison.

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Garries Promoted to Area Manager by Core Well

Lloyd C. Garries has been promoted to area manager in Saskatchewan by Core Well, Ltd., Canada, according to Leonard Vickertsaff, vice president of Core Well. Garries will be based at Weyburn.

Two new coring engineers are also being added to Core Well's staff and will be based at Estevan and Oxbow.

LEGAL

Sealed bids will be received until July 31, 1957, 2:00 P.M., Mountain Standard Time, and opened at that time in the Office of the Superintendent, Crow Indian Agency, Crow Agency, Montana, for the leasing of 2,267.20 acres of Tribal land located in Township 1 N., R. 36 E.; T. 3 N., R. 34 E; and T. 3 N., R. 35 E., Big Horn and Treasure Counties, Montana, for oil and gas mining purposes. The details of the lease offering and how and where to file bids may be obtained by addressing the inquiry to the Superintendent of Crow Indian Agency, at Crow Agency, Montana.

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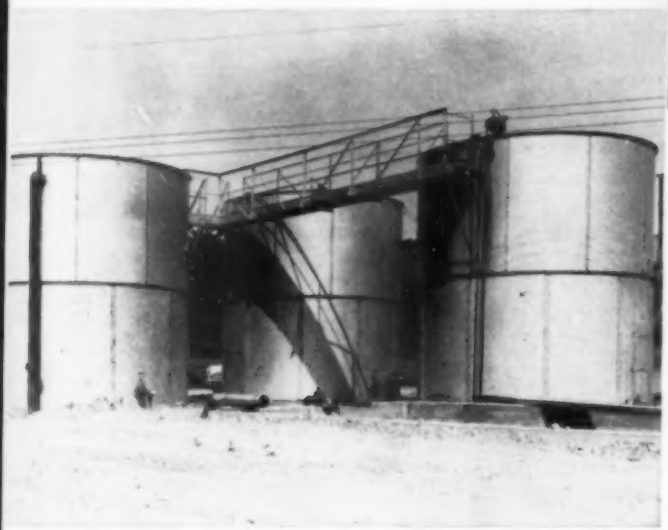

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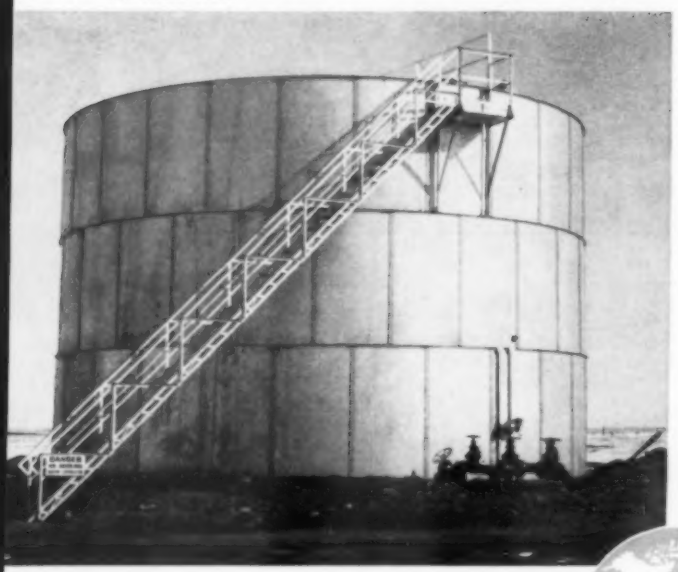

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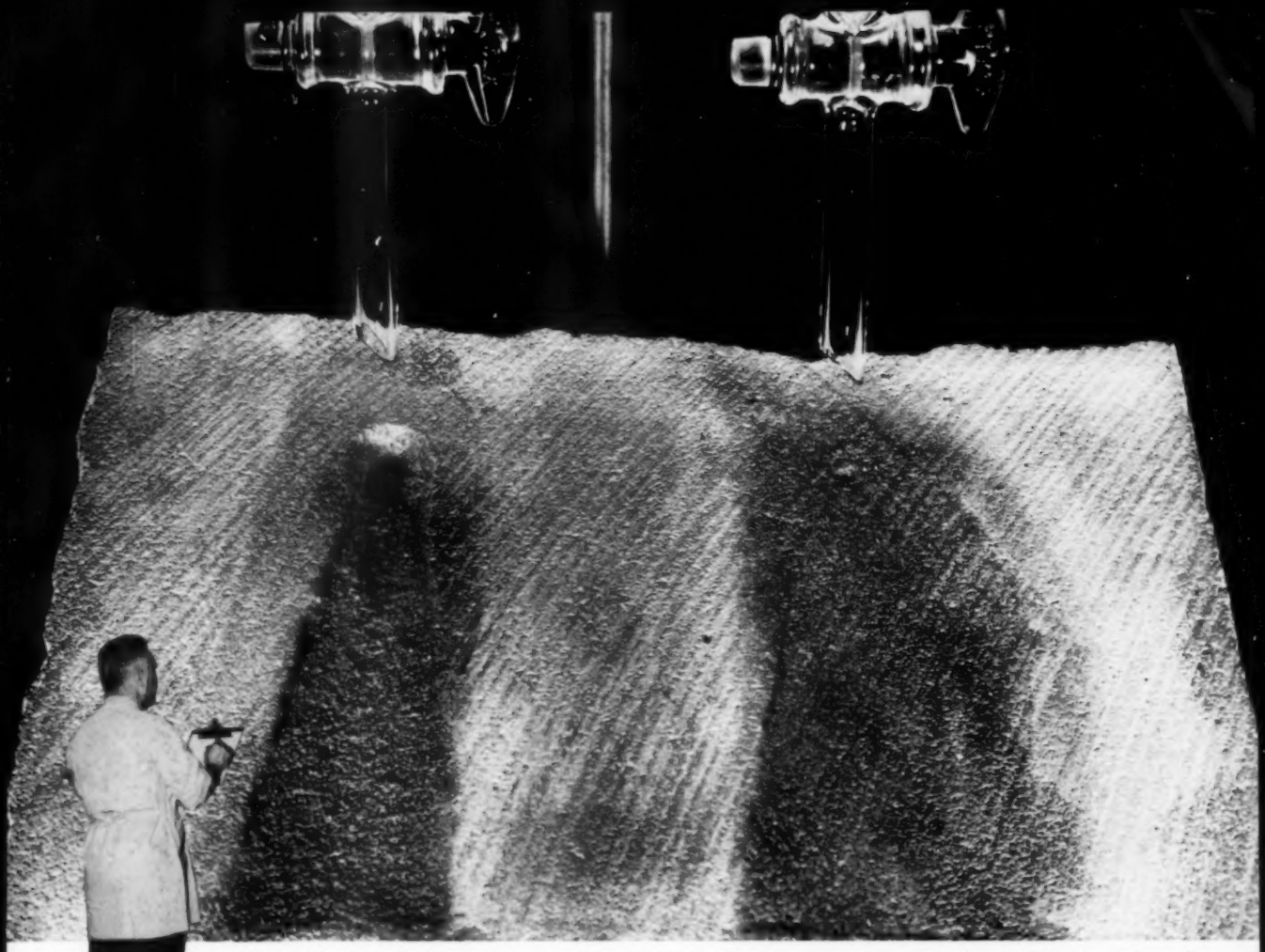
NATIONAL TANK COMPANY

TULSA, OKLAHOMA



Reaction rate of Retarded Acid (right) is slower than that of regular acid, allows greater penetration into formation before completely spending.

get a faster payout with a RETARDED ACID

Certain formations, notably fast-reacting fractured or vugular limestones, respond better to a retarded acid than to either regular acid or fracturing treatments.

Dowell offers *two* acids with a retarded action. Each is especially suited to treating certain variations of these limey formations.

First, there's Dowell Retarded Acid. It is a regular acid with a special Dowell-developed additive that slows down acid action after the formation is initially etched. It gives excellent results in some cases where no other treatments are profitable.

Second, there's Acid Petrofrac®. It employs an acid-oil emulsion that reacts slowly until the emulsion is broken. This emulsion has been extremely successful when used as a retarded acid.

Perhaps your producing zone is the other extreme—a slow-reacting dolomite that responds best to an intensified acid. In any case, you may be sure that your Dowell Engineer can tailor the right treatment for your well.

For more information or service, call any of the 165 Dowell offices in the United States and Canada; in Venezuela, contact United Oilwell Service, or write to Dowell Incorporated, Tulsa 1, Oklahoma.

Services for the oil industry

DOWELL

A SERVICE SUBSIDIARY OF THE DOW CHEMICAL COMPANY

why offshore operators prefer "FLASH-WELD"

With operating costs in the Gulf running as high as $400 per hour, downtime to change tool joints is prohibitive.

That's why a vast majority of the offshore operators are running drilling strings unitized with hardfaced "Flash-Weld" joints. Never has preference for a product been so clearly demonstrated.

Safety, dependability and *economy* — the three reasons that have made "Flash-Weld" the outstanding choice offshore — are the same reasons operators, generally, have long preferred this superior tool joint-to-pipe connection.

Pioneered and developed by HUGHES, "Flash-Weld" tool joints have been used in unitizing more than 36,000,000 feet of drill pipe.

FLASH-WELD
A DEVELOPMENT
OF
HUGHES
TOOL COMPANY
HOUSTON, TEXAS

Developers of "Flash-Weld," "Seal-Grip" and Counterbore Weld Tool Joints